The Dock and Harbour Authority

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Editorial Comments

A Great Swedish Port.

As Major Petterson points out in the article on recent developments at the Port of Gothenburg which is published in this number, the port has previously received prominent notice in the columns of this Journal, having formed the subject of a leading article and illustrated supplement in January, 1925.

But thirteen years is a long stretch of time, and in these days of rapid progress, many changes take place within relatively short periods, so that during a recent visit to the port, when we had an opportunity of inspecting developments which were everywhere in evidence, we felt that the time was ripe for a further notice, and we invited Major Petterson, who prepared the earlier article, to contribute another, covering the more recent period. This he has done, and our readers are now afforded an opportunity of learning about the extensions and improvements which have been carried out at the renowned Swedish port.

Sweden, as indeed is the case with all the Scandinavian countries, is essentially a seafaring nation. Its extensive seaboard, with numerous sheltered inlets, is eminently adapted to the promotion of traffic by water so that, right onward from the days of the Vikings, Swedes have been navigators and adventurers. Amongst other centres deriving their importance from their maritime associations, Gothenburg stands in the foremost rank. It is a name familiar to British seamen, to British merchants, and to the British people. With its population of about a quarter of a million, it is the second largest city and the most important commercial centre of Sweden. The settlement, although of old standing, was in its modern form, established early in the 17th century by King Gustavus Adolphus, who, according to the local legend, decided on the site from observation of the chase and escape to refuge at his feet of a bird pursued by an eagle—a legend which is commemorated by a monument in Gustav Adolf Square. The aid of the Netherlanders was secured to drain the marshland and to cut canals which exist to the present day. They excavated a moat, which still separates the oldest part of the city from the new.

This digression into what is now ancient history merely serves as a foil to set off the modernistic developments and up-to-date equipment which now characterises the port. We must leave Major Petterson, who, as Chief Engineer of the port, is best qualified to do so, to describe the various features of the new quays and sheds which have been constructed under his direction.

Like Stockholm, Gothenburg has a charming approach through an archipelago, among which and along the coast-line are to be found a number of attractive little bathing resorts. In the background are vast forests, rich mineral deposits and a plentiful supply of water power, a large proportion of which has already been usefully exploited. Enjoying as it does all these natural advantages, which have brought it into direct overseas communication with all parts of the world, there should be a future of uninterrupted progress and prosperity before the port under the guidance of its experienced harbour administration.

The Future of Canals.

The Paper read before the Institute of Transport in December by Mr. George Cadbury on the Economic Future of Canals, a first instalment of which is reproduced in this issue, comes appropriately in sequence to the article on the War-time Operation of Ports, by Mr. Ross-Johnson, which appeared in our last number. Mr. Ross-Johnson, it will be recalled, emphasised the value of the country's neglected system of internal waterways, and urged their rehabilitation in the national interest. Mr. Cadbury, than whom no one has a more intimate knowledge of the conditions prevailing in connection with canal traffic at the present day, contends for a recognition of inland waterways as one of the most important assets in the resources of the community, and one which should become an integral part of any national co-ordinated scheme of transport. He points to the prominence which inland waterways occupy in Continental countries, and claims that if properly constructed and developed, with adequate terminal and general facilities, they are, or may become, the cheapest means of transport for certain commodities.

Unfortunately, these arguments have been advanced so often that they have lost the first sharpness of incisive conviction. Royal Commissions and Departmental Committees have heard, admitted and adopted them, time and again, but still the position of matters remains very much as it was thirty or more years ago. With the exception of a few undertakings, which, in the last few years, have displayed a commendable degree of enterprise, canals continue to be the same out-of-date, in some cases almost derelict, survivals of a remote past—practically incapable of resuscitation or of galvanising into renewed life. And yet, in the aggregate, the mileage of canals and inland waterways in Great Britain is between three and four thousand, and represents a capital outlay of enormous importance, which surely demands some effort to retrieve its value before being written off as a "bad debt."

Mr. Cadbury rightly points to the activity of canal and inland waterway authorities on the Continent, where large sums have been expended on the development of water transport. In north-western Europe, Holland has recently constructed the Juliana Canal in connection with River Maas, between Maestrecht and Wessem, so forming a link in the chain from the first-named town right through to Dordrecht and Rotterdam. Further, the Twente Canal from Zutphen to Enschede was opened last year, connecting the industrial area round Enschede with the Upper Rhine and the Yssel. In Belgium, the Albert Canal, running from Liege to Antwerp, is making good progress, and it is expected that it will be in commission by 1940, if not before. In Germany, the Mittelland Canal is rapidly nearing completion, while in Russia, a great programme of waterway development is in progress, of which one of the most notable features, the Moscow-Volga Canal, was described in this Journal at the time of its opening in July last.

All these undertakings are for traffic units of considerably higher calibre than any to be found in this country. The 30-ton "monkey boats" in the Midland and Southern districts of England make a sorry appearance in comparison with 1,000, 1,500 and even 2,000-ton craft in the Low Countries. Until some means can be devised of rendering the canals of this country capable of accommodating larger transport units, it is difficult to see how they are going to be economically operated.

An interesting point in Mr. Cadbury's Paper was the suggestion that river navigation should come under the jurisdiction of the new Catchment Boards formed in connection with the Land Drainage Act, 1930. At first sight, the unification of all river interests under a single controlling body is an attractive proposition, but it requires careful consideration. Unification

Editorial Comments—continued

of control where it can be achieved satisfactorily is undoubtedly an advantage, but the interests of navigation and land drainage present several divergent aspects and, as came out in the discussion on the paper, representatives of these two interests are drawn from different circles and have little in common with one another. Navigation is bound up with commerce and industry, while land drainage is concerned almost entirely with the requirements of agriculture and health. Occasionally it may happen that the objects pursued may be incompatible with one another, and the final decision should not then be left to the preponderant majority of one of the parties to a dispute.

Marine Depredations in Harbour Waters.

With the article on depredations by marine organisms in Blyth Harbour published in this issue, we return to a topic which was ventilated in these columns some months ago by the publication of the report relating to Sydney Harbour, New South Wales. The damage shown to be done in that locality is paralleled by the experience at the English port; but, while the arch enemy in the Antipodes is Teredo, locally called Cobra, at Blyth Harbour there is stated to be no evidence of the existence of that particular borer—such is the strange inconsistency of the records of the activities of these organisms, concerning the habits and localisation of which further investigations are proceeding in many places. Until the enquiries are complete, it is not possible to decide upon an effective plan of campaign for the restriction and possible extermination of an array of pests which are responsible for damage amounting to many thousands of pounds every year. Attacks are so covert and insidious that irreparable harm may have been done before the mischief is disclosed. No timber, so far as is known, is immune from attack. The discovery of a remedy would do much to relieve the anxiety felt by harbour authorities and contractors for harbour works, to say nothing of the vast number of small jetty and wharf proprietors whose property has suffered in varying degree.

Labour Registration at Scottish Ports.

The long awaited report of the Board of Inquiry into the question of Labour Registration at the ports of Glasgow and Aberdeen, which was appointed in January last year, appeared after we had gone to press with our last month's issue and, therefore, was too late for comment therein. It is a lengthy and important document, requiring close consideration in order to appreciate the numerous points involved, and a word of commendation must be said at the outset on the careful and painstaking manner in which the members of the Commission have discharged their onerous task.

Our readers will recall that while at most, if not all, English ports of importance, systems of registration for the regulation of port labour have now been introduced with an appreciable measure of success, a similar result has not been achieved at two leading ports in the North. Representations to that effect were made to the Ministry of Labour by organisations of both employers and employed in the Port Transport Industry, in consequence of which the Board of Inquiry, consisting of Sheriff Dr. Irvine, K.C., as chairman, with Sir James Leishman and Professor Murray Taylor as colleagues, was appointed by the Ministry.

The instructions to the Board were to investigate the circumstances giving rise to the difficulties experienced at the ports of Aberdeen and Glasgow. The report shows that a very careful and searching investigation was made, with a patient hearing of all the evidence led, either proffered or in response to invitation, and an unbiased weighing of the statements and allegations put forward by all the parties involved.

Our readers had the opportunity of perusing condensed reports of the evidence in our issues of April and May, 1937. It is unnecessary, therefore, to traverse the ground again, especially as there appears on another page in this issue an excerpt from the Board's Report containing a general summary with the Commissioners' conclusions and their recommendation.

We do, however, feel it desirable to call attention to the very regrettable indifference displayed by the employers, who to all intents and purposes, connived at fraudulent practices on the part of their men, in an abuse of the administration of the National Unemployment Fund. Reprehensible and criminal as are the practices alleged to have been common among the men, in withholding or failing to produce their unemployment books and in giving fictitious names, for the purpose of defrauding the Fund, the employers do not escape censure for their tacit acquiescence therein and their neglect to make adequate, or, indeed, any, enquiries. The Report points out that under the statute it is the duty of an employer to obtain an unemployment book, or a receipt for an unemployment book from the employed person at, or immediately after, the commencement of the employment. It is plain, it adds, that the irregularities in non-payment of insurance contributions and in the insertion of fictitious names in emergency books could not have occurred if the employers had acted in conformity with statutory requirements. The plea put forward that observance of the statutory requirements would have resulted in ships being held up for lack of labour is rejected as being unsupported by any evidence, and the Commission rightly declined to accept the view that port work could only be carried on at the price of disregarding, or condoning, fraudulent claims on the public funds.

But having in no uncertain terms reproved the employers, the Report contains an equally adverse reflection on the conduct of the men, though expressed in language rather less severe. It would certainly appear, on the face of matters, that the reluctance of the men to accept registration in any form was due, in a large measure, to the fact that the opportunities which have existed in the past for illegally obtaining unemployment relief would cease. The specious allegations that registration meant industrial conscription and regimentation cannot, in view of the experience at other ports, be considered tenable. The crux of the matter is set down in the following extract from the Report: "In Aberdeen, as in Glasgow and other ports, it is not uncommon for men who are earning high wages at piece-work for a certain number of days in a week, to 'rest' during other days of that week, and claim unemployment benefit in respect of those days on which they are unemployed. All men do not claim unemployment benefit during a 'resting period,' but in most cases benefit is claimed. It is left to the individual to make his decision on that matter in view of the particular circumstances. When high wages can be earned by piece-work, night shifts or overtime, the habit of working at high pressure for a few days and then 'laying off' for the next few days is one of old standing and existed long before dockers came within the scope of the Unemployment Insurance Scheme. The habit still continues. The introduction of the Insurance Scheme has not altered the habit, and has enabled high earnings for two or three days' work during a week to be supplemented by the unemployment benefit in respect of the other days of that week." Such fraudulent conduct calls for the severest censure. In view of the statistics furnished from labour exchanges in Glasgow that out of 3,612 blank Emergency Books issued, no fewer than 3,199 were found to contain apparently fictitious names, the practice has clearly been widespread, and the sooner it is checked the better.

The proposals of the Board of Inquiry for the establishment of Joint Committees representing both the employers and the Trade Unions (for the workmen) with the provision of appropriately distributed stances, or calling-on places, and the recognition of union membership as the basis of enrolment on the register, may or may not obtain the whole-hearted support of the interests concerned, and the Board of Inquiry themselves adopt the attitude of regarding it as experimental and subject to modification in the light of experience. At any rate, it has the merit of being an honest attempt at reconciling two conflicting points of view, and is well worth a trial. Everything depends on the spirit in which the proposals are received, alike by the men as by the employers. An atmosphere of reasonable and amicable co-operation would dispel the latent distrust of the men and enable them to accept a principle already established at other ports. But the present grave irregularities in the matter of unemployment relief must be stopped at once in the general interests of the community.

Since the report was issued, it has been announced in the press that the Aberdeen branch of the Transport and General Workers' Union would offer no objection to the establishment of calling-on stances for labour at the docks, as suggested in the Report, and this is a satisfactory indication of the workers' disposition to fall into line with the proposals of the Board of Inquiry.

Shipbuilding Returns.

There is scarcely anything remarkable disclosed in the statistics contained in Lloyd's Register Shipbuilding Returns for the Quarter ended 31st December last. Despite some slight fluctuation in the distribution of the figures, the total amount of shipbuilding in hand throughout the world is much about the same as it was in the return for the preceding quarter. There has been a relatively small decrease of just under 60,000 tons in the work in hand in Great Britain and Ireland, and decreases are to be noted also in the cases of Japan, Germany and the United States. On the other hand, Holland, Italy, Sweden, Finland and the autonomous city of Dantzig are able to show increases, which more or less counterbalance the decreases. Spread over the complete period of twelve months, there is an aggregate increase in the world tonnage under construction of 650,000 tons.

As regards Great Britain and Ireland, the present total of 1,125,426 tons is less by 59,209 tons than it was three months ago, but 161,784 tons greater than a year ago. Moreover, it is very considerably in excess of the aggregate tonnage now under construction in the three leading countries abroad. It represents, in fact, 38.8 per cent. of the world's total of tonnage under construction.

PORT OF GOTHENBURG.

CHIEF ENGINEER TO THE GOTHENBURG PORT & HARBOUR BOARD;—MAJOR KNUT E. PETTERSON.

Scale of Metres.

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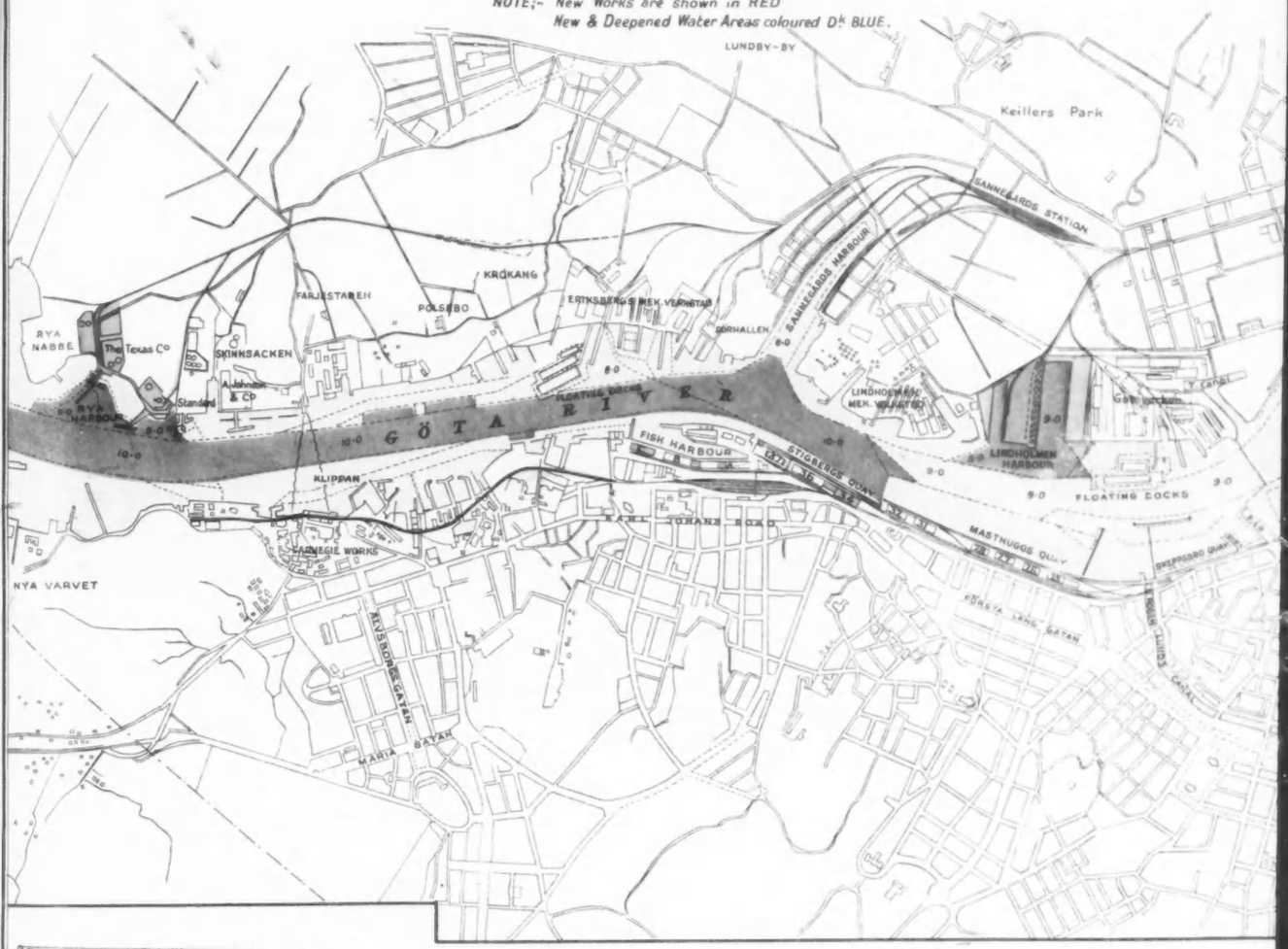
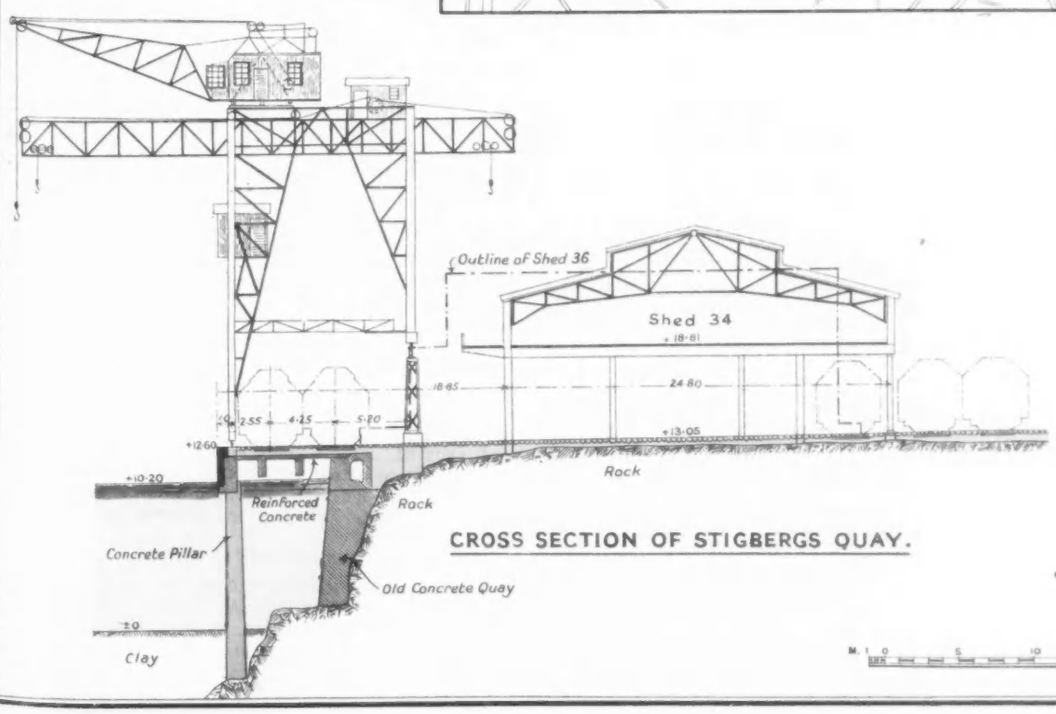
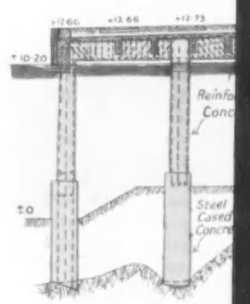
1 Metre = 3·28 Feet

NOTE;- New Works are shown in RED
New & Deepened Water Areas coloured Dk BLUE.





CROSS SECTION OF STIGBERGS QUAY.



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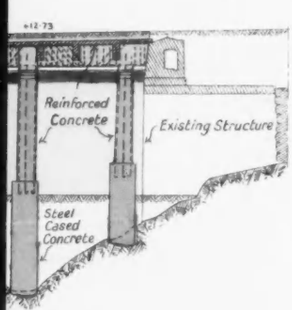

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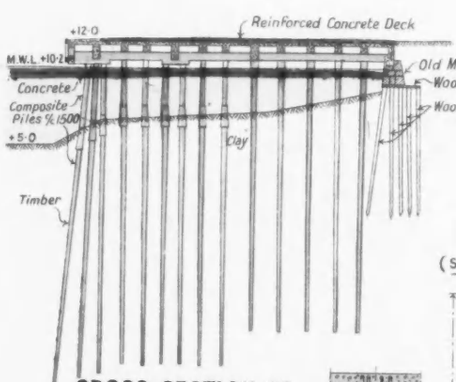

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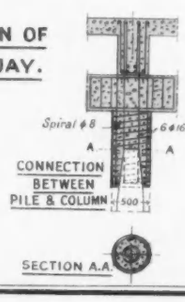

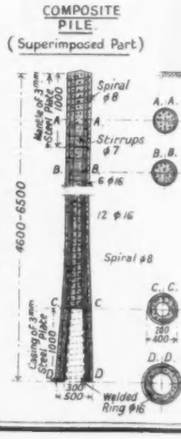

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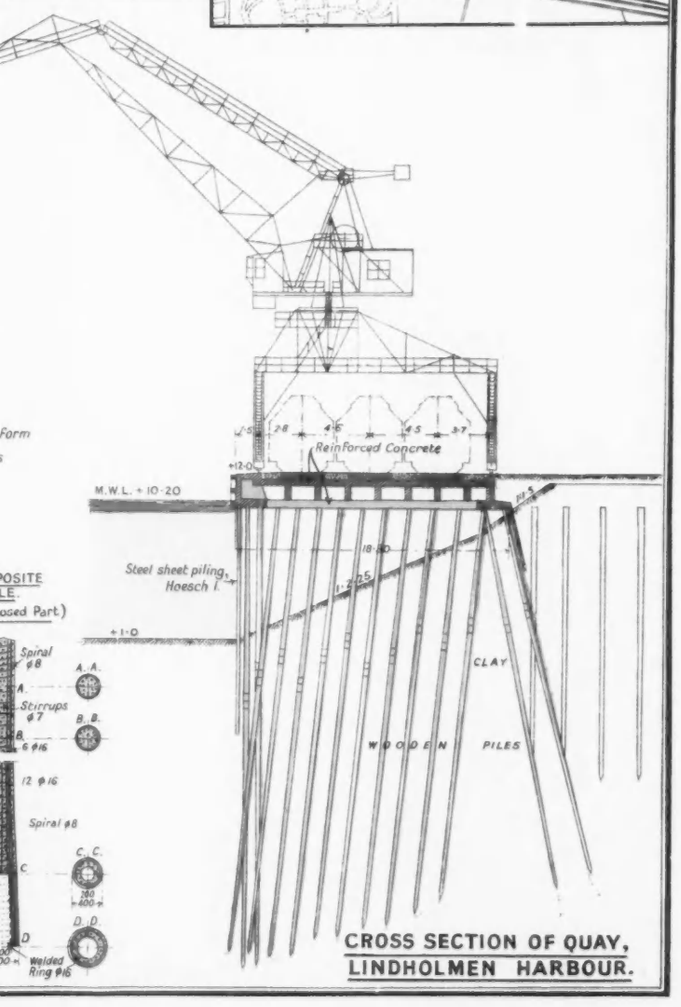


CROSS SECTION OF QUAY,
LINDHOLMEN HARBOUR.

The Port of Gothenburg

Recent Developments at leading Swedish Port

By Major KNUT E. PETTERSON, Chief Engineer of the Port

Introductory Note

IN the year 1925 I wrote an article which appeared in the issue of this Journal for January (No. 51, Vol. V). The Editor, when paying a recent visit to our Port, asked me to give some details of the various works, carried out at the Port of Gothenburg, since my previous description was published in the article mentioned above. Although no large harbour works have been executed, a number of improvements have been made, which will be described hereunder.

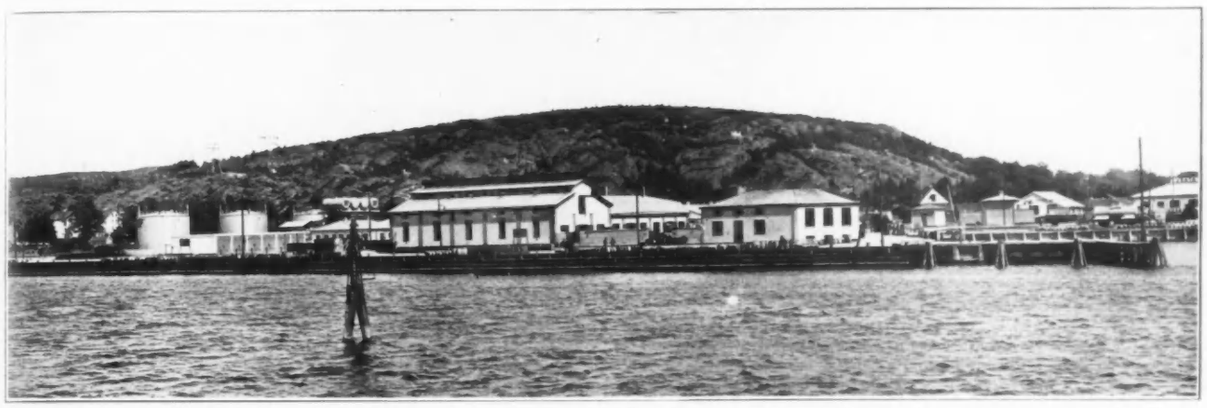


Fig. 1. The Lärje Harbour.

In the Supplement accompanying this article, the new works have been marked in red. I shall commence with the southern river bank and proceed from west to east.

The Southern River Bank

The Harbour Railway has been extended for a length of 2,600 m. (8,530-ft.) as far as the Carnegie Works, a large industrial establishment at the mouth of the river.

The Fish Harbour

A new fish hall, the third in number and called "C," was completed in 1925; it is a one-storey building with a length of 90 m. (295-ft.) and the same width, 21 m. (69-ft.), as the other halls. Later on, certain spaces between the two older halls have been roofed in, thus providing greater space for the auctions.

The Stigbergs Quay

A new quay front, giving an increased depth of 10.0 m. (32.8-ft.) over a length of 205 m. (672½-ft.), has been executed in connection with the straightening of the eastern part of the quay, whereby the quay has become rectilinear throughout its entire length of 477 m. (1,564½-ft.). In connection herewith, the quay area has been widened, and a new two-storied goods shed, No. 34, of steel and concrete has been erected, containing 3,900 sq. m. of floor space. The construction of the quay is shown in the Supplement. A view of shed, No. 34, is shown in Fig. 4. At present work is going on with a 25 m. (82-ft.) long extension of the quay towards the west, with a depth alongside of 7 m. (23-ft.)—the same depth as the western part of the quay. This part of the quay is the mooring place for London steamers, which require improved quay accommodations owing to the increased traffic. In 1934 the shed No. 37, called the "England Shed," situated on this quay, was extended by 10 m. (32.8-ft.) towards the east, and will now be extended 10 m. also, towards the west.

The Packhus Quay

This quay has been widened by 8 m. (26¼-ft.) at the Stora Hommens Harbour. At the same time the Great Custom House was widened by 8 m., thereby gaining about 400 sq. m. of covered area. The widening of the quay has been effected in the form of a wharf on composite piles of wood and steel, the construction of which will be described in detail below.

The Gullbergs Quay

On this quay, a length of 400 m. (1,312-ft.), has been widened by about 22 m. (72-ft.), and at present a similar widening of a further length of 110 m. (361-ft.) is being carried out. On the widened quay two new goods sheds, Nos. 213 and 215, have been erected, each with 550 sq. m. of floor space. At the same time the water depth at the front of the quay was increased to 5.0 and 6.0 metres respectively. The widening takes the form of a concrete wharf on composite piles. The construction is shown in the Supplement. At the inner part of the widening the superimposed piles are very short and have been moulded on the site. An illustration of the concrete top of the composite pile is shown in the Supplement, while the pre-cast concrete piles are shown in the illustration (Fig. 8).

The Gas Works Quay

To a length of 280 m. (918-ft.) this quay has been widened by 6 m. (19½-ft.) as a wharf of wood and steel on composite piles, same as above. At the same time the water depth alongside has been increased to 5.8 m.

The Lärje Harbour

A new and smaller harbour for inflammable oils has been constructed at the upper part of the Harbour district. It is intended for the distribution of oils in the city and its environs, and also for transport by ships up the Göta River. The harbour consists partly of two basins which, in the ordinary way, can be shut off from the river by floating booms in order to prevent oil from spreading out into the river in the event of leakage, partly of loading wharves built along the river frontage and executed in combined wooden and steel structures. The total length of the quay is 643 m. (2,109-ft.), of which 302 m. (990½-ft.) for 3.5 m. water depth in the basins and 341 m. for 3.0 m. water depth at the wharves along the river front. The ground areas at the basins are let out to private concerns, who have there erected their own tank establishments, warehouses, garages, etc. Fig. 1 shows a view of the harbour from the river. Furthest to the right the entrance of the closed basin can be seen.

The Northern River Bank

Commencing from west, as before, we have, first, the "Rya Harbour." At the outer end of the harbour district near the outlet of the Göta River into the Älvsborgs Fjord, a special oil harbour, hitherto lacking in Gothenburg, has been built. It is a separate harbour for the import of combustible oil direct from the transoceanic oil exporting ports. This harbour is also used for the bunkering of large and small ships. The harbour frontage consists of two piers of about 165 m. (541-ft.) in length each, with 9.0 m. water depth alongside, and with a water depth of 4.0 m. in the inner part of the harbour. Further, there have been built a couple of smaller concrete quays at the inner ends of the wharves for a water depth of 4.0 m., chiefly intended for fishing boats and small motor vessels engaged in

Port of Gothenburg—continued

Fig. 2. Cranes in the Sannegards Coal Harbour.

coastal traffic to adjacent parts of the country. The length of quay for a water depth of 9.0 m. is 330 m. (1,082-ft.) and for 4.0 m. water depth of 205 m. (672-ft.). As a rule, the oil tanks are built directly on a rock foundation and at so high a level that the oil can circulate by gravity. The harbour, which is situated some distance from the central part of the city, is connected with the town by a special road and by its own railway with station and sidings. The wharves are built as light timber structures, at certain intervals supported by strong dolphins of concrete on wooden piles. Teredo attack is very prevalent, and therefore all bearing piles have to be protected against them. The piles are protected by nailing, 4,000 1¼-in. nails being driven into each square metre of pile surface. For this nailing nearly 25 million nails have been used, and so far the protection has proved effective. The concrete dolphins are placed at intervals varying between 25 and 40 m. The weight of the concrete in each of the dolphins is about 80 tons. The outer detached dolphin at the west wharf is entirely protected by a steel sheet piling. Fig. 7 shows the procedure of sinking the sheet piling of this dolphin, which was placed into a pit previously dredged. Its weight is 70 tons. Fig. 3 shows the Rya establishment viewed from the river.

The Lindholmen Harbour

In order to satisfy the demand for new quay spaces, a new harbour, consisting of two basins with a pier between them, has been commenced upon the ground between the two shipping yards, Lindholmens Mekaniska Verkstad and Götaverken. In the western basin, having a water depth of 5.0 m., 200 m. (656-ft.) of quay has been built at the east side of the basin. The eastern basin, with a water depth of 9.0 m., is under construction, and is expected to be completed in 1939. The total length of quay is 660 m. (2,165-ft.). When being planned, the harbour was intended to be used mainly for the imports of fodder and similar materials, and it would comprise the pier between the two basins with 9 m. quay on one side for shipping in the import trade and 5 m. quay on the other side for loading vessels sailing to other Swedish ports, etc. Later on, however, it was decided to build also the eastern quay at the 9 m. basin and, further, a connecting quay to Götaverken shipyard. This quay along the river front will be constructed for 8.0 m. depth of water. For the time being, the berth at the outer end of the pier will be dredged to give a depth of 4 to 5 m. only. The construction of the quay is shown in the Supplement, giving a cross-section of the quay for 9.0 m. depth of water, with cranes and railway tracks.

The Free Harbour

On the northern side of the basin the quay has been extended by 30 m. towards east, and on the southern side by 30 m. as well. By building a 20 m. long transverse quay with a water depth of 6.0 m. at the east side of the inner end of the basin a useful extension of 60 m. (197-ft.) has been obtained. The quay is built on wooden piles, supporting a reinforced concrete deck, the connection between the wooden piles and the concrete deck being effected through reinforced concrete sockets, similar to what has been described for the inner part of the widening of the Gullbergs Quay. In the Free Harbour four new goods sheds have been built: No. 102 in two storeys with 7,400 sq. m. floor space, and with refrigerating accommodation in the base-

Fig. 3. General View of Rya Oil Harbour.

Port of Gothenburg

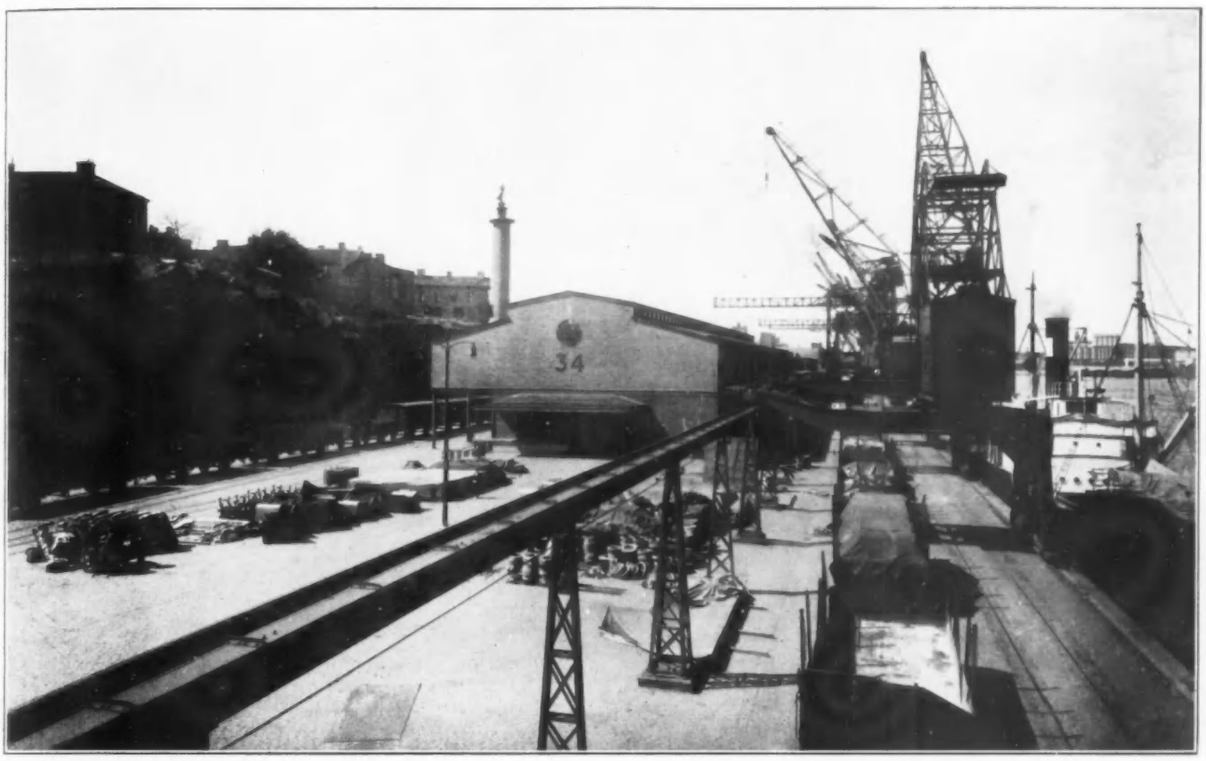


Fig. 4. The Stigsbergs Quay, looking East.

Fig. 5. Shed in Free Harbour.

Port of Gothenburg—continued

ment, No. 107 in one storey with 1,400 sq. m. floor space, No. 109-111 in two storeys with 6,000 sq. m. floor space, and No. IV in one storey with 3,800 sq. m. floor space. A few of these sheds are shown in the illustrations (Fig. 5 and Fig. 6). The sheds No. 102 (Fig. 5), No. 107 and No. 109-111 (Fig. 6) are located close to the quay, and are used for general merchandise. No. IV is situated far from the quay, and is intended for the receipt of goods to be stored, mostly imported motor cars.

Lifting Cranes

Owing to the increased demand for quick and powerful loading and discharging facilities, a demand which is always more or less in evidence, the crane equipment of the harbour has undergone considerable improvement during the last ten years by the modernizing of old cranes and by installing a number of new cranes. The modernizing has been done in the direction of increasing the slewing radius, the speed of working, and the mobility of the crane jibs.

The number of cranes has been increased from 100 to 142. In addition, another 32 cranes have been purchased during 1937. Thus the total number during the current year is expected to be 174. Since the year 1925, 30 cranes of the older types have been transformed into luffing cranes with slewing jib and increased slewing radius.

the 22 tons crane at the Masthuggs Quay and of the steam cranes have been withdrawn from service. The total crane lifting capacity, in tons, has been increased, since 1925, from 505 tons to 894 tons, including the cranes ordered in 1937.

The distribution of the cranes over the different quays and parts of the harbour is given in the table below, in which the figures in brackets refer to newly-ordered cranes.

Location	Number of cranes and lifting capacity in tons								Total
	1½	2½	3	4	5	6	22	80	
Gas Works Quay, coal					6				6
Gullbergs Quay	1				4				5
Packhus Quay		2			10				12
Skeppsbro Quay	1				2				3
Masthuggs Quay		4			33		1		38
Stigbergs Quay	4	4	4		7				19
Free Harbour		15			16				31
Lindholmen Harbour					4				4
					(32)				(32)
Sannegards Harbour, coal and coke				4	5	12			21
					(1)	(20)			(25)
Inner Canals					1				1
The Harbour (floating cranes) ...						1*		1	2
	6	25	4	4	88	13	1	1	142
					(112)	(21)			(174)

*Also used as general cargo crane with 12 tons lifting capacity.

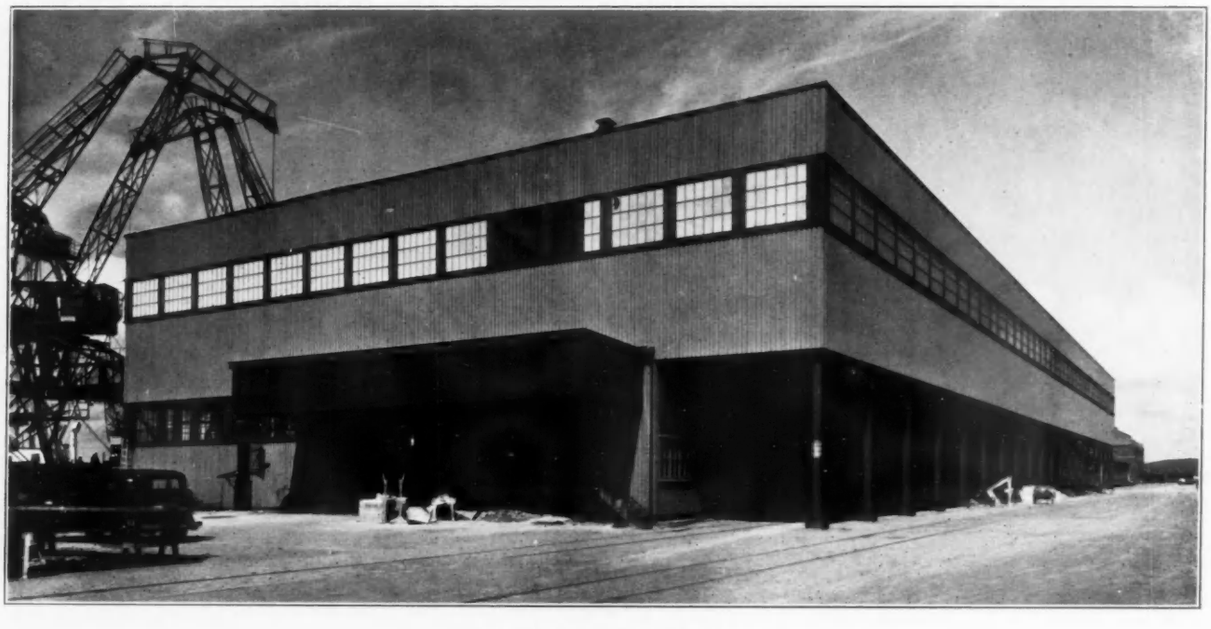


Fig. 6. Shed in Free Harbour.

In the coal harbour (the Sannegards Harbour) coke has driven out the coal more and more, and has caused a rather important alteration of the business. Nine crushing-works have been erected, and the transhipment from import steamers to vessels lying outside these and trading along the coast has been considerably increased. In order to meet this traffic, 12 cranes of 6 tons capacity with 15.5 m. rail-span, spanning three railway lines, and with 27.5 m. projection of the crane jib, have been erected. Fig. 2 shows an illustration of these cranes, of which another 8 will be erected. The old single portal grab cranes have been altered in this connection to general cargo cranes, and have been transferred to other quays. A Diesel electric pontoon crane, which can serve either as a grab crane with 6 tons capacity at 24 m. outreach or as a general cargo crane with a lifting capacity of 12 tons at 12 m. outreach, has been bought. At the Stigbergs Quay the mooring place of the Swedish American Liners, 4 large double cranes have been erected, generally provided with a slewing jib and with a travelling trolley traverse moving in a rectangular direction towards the quay. The lifting capacities of these cranes are: for the slewing crane, 3 tons; and for the travelling crab crane on the traverse, 1.5 tons. The traverse is placed 19 m. above the quay level, and the travelling trolley can reach 14 m. seaward and 17.3 m. landward, measured from the outer crane rail. The Supplement shows a cross-section of these cranes and their positions in relation to quay and sheds, etc.

For the Lindholmen Quay, at present in course of construction, 24 out of the 32 newly-bought cranes will be erected there. Most of these are full portal cranes with 15.5 m. rail-span, spanning three railway lines and with 27.5 m. outreach, see the quay section, etc., in the Supplement.

All cranes procured after 1925 are characterised by luffing movements. The old stationary cranes with the exception of

In the table below the cranes are arranged according to type.

	Number of cranes and lifting capacity in tons								Total
	1½	2½	3	4	5	6	22	80	
GENERAL CARGO CRANES									
Stationary, electric					1				1
Portal Crane, electric	6	25		4	76				111
					(100)				(135)
GRAB CRANES									
Portal Cranes, electric					10	12		22	
						(20)		(30)	
Overhead Electric Travelling Cranes				4	1				5
Floating Crane, electric ...						1*			1
									—
,, ,, steam								1	1
Stationary Crane, manual ...							1		1
	6	25	4	4	88	13	1	1	142
					(112)	(21)			(174)

*Also used as general cargo crane with 12 tons lifting capacity.

Moorings

The mooring areas in the river, equipped with buoys, have been diminished by the extension of the quays and by the floating docks so that they now afford berthage for 32 vessels only instead of the 45 in 1925. This is partly due to the lengthening of certain buoy mooring places, which have also been given greater depths, intended as they are for larger vessels.

Goods Sheds

Since 1925, as mentioned before, 8 new goods sheds have been erected in the harbour, 4 of these in the Custom Harbour and 4 in the Free Harbour. Three of the latter are built in two stories with basement and refrigeration accommodation in one of them. The total floor space has been increased, since 1925,

Port of Gothenburg

Fig. 7. Sinking Dolphin at Rya Harbour.

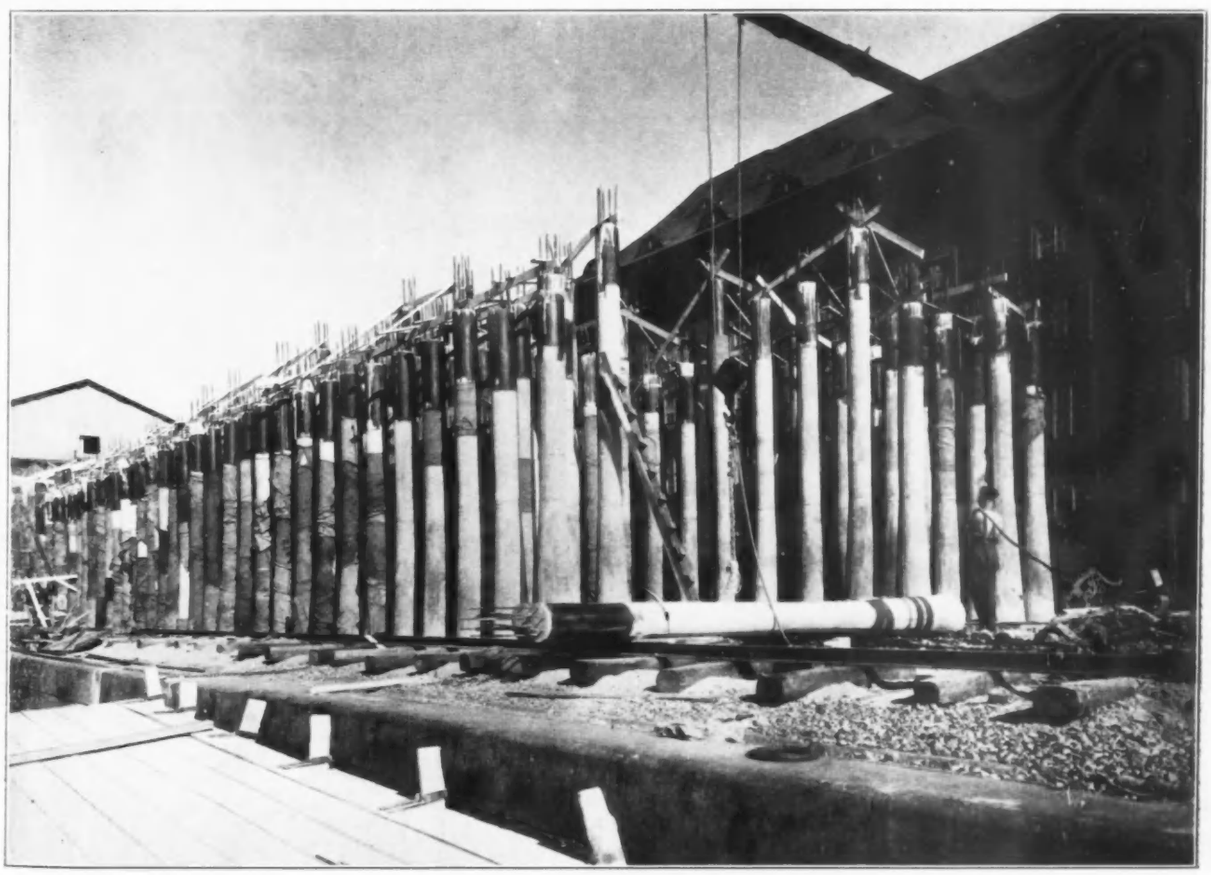


Fig. 8. Gullbergs Quay Widening.

Port of Gothenburg—continued

from 34,000 sq. m. to 83,000 sq. m. The figures for the Free Harbour are 17,000 sq. m. and 40,800 sq. m. respectively. It has recently been decided to erect a new shed in the Free Harbour, which will further increase the area by 3,700 sq. m., totalling 86,700 sq. m.

Railways

In connection with new buildings and quay structures, the harbour railways have been considerably extended, and since 1925 the total length of rail track has been increased from 53.5 kilometres to 95 kilometres. The greatest increase is due to the erection of a new harbour ranging station in the neighbourhood of the main station, to re-arrangement at the Free Harbour station in connection with a new bridge across the Göta River, the extension of the station at the Sannegards Harbour for the new Lindholmens Quay and to the new railway to the oil harbour at Rya mentioned above.

Shipyards and Docks

The projected floating dock at Eriksbergs Mekaniska Verkstad mentioned in the previous article, has attained a length 183 m. (600-ft.), a free width of 27 m. (88½-ft.), and a lifting capacity of 20,000 tons. For the purpose of docking a large new-built ship, the "Stockholm," contracted for by the Swedish American Line, this dock will now be extended to 196 m. (643-ft.), whereby the lifting capacity will be increased to 22,000 tons. The floating docks at Götaverken have been rebuilt as well, and now consist of two separate docks 8,000 and 18,000 tons lifting capacity respectively, with lengths of 122 m. (400-ft.) and 180 m. (590-ft.) respectively. Both of these have the same clear width of 25 m. (82-ft.).

General Matters

The lighthouses at Böttö, Geveskär and Knippelholmen belonging to the Port of Gothenburg and situated at the entrance of the harbour, have been modernized by substituting for the old fog syrens, driven by hand, new ones, driven electrically. They are connected with one another by submarine cables and are worked from a centre at Böttö.

In severe winters, with massive ice, it has occurred that the previous ice-breakers were not powerful enough to keep open the entrance channel, leading up to harbour, especially as the size of the vessels, now trading on the harbour, is steadily increasing. Therefore a large sea-going ice-breaker has had to be procured. The ship, bearing the name of "Göta Lejon," has a length of 56 m. (183½-ft.), a width of 15 m. (49-ft.), a draught of 6.0 m. (19½-ft.), and an engine power of 4,000 h.p. She is expected to keep the traffic to the Port of Gothenburg open even under the most difficult ice conditions.

The present bridge connection across the river, the "Hisings Bridge," has proved insufficient for both land and sea traffic. In 1934, therefore, it was decided to build a new bridge, situated east of the Lilla Bommens Harbour. It will afford 19.5 m. (64-ft.) free navigation height and about 20 m. (65½-ft.) clear navigation width. This bridge, which is shown in the Supplement, is now under construction and is reckoned to be ready in 1939. This bridge work necessitates a great deal of other work on both sides of the river, such as a partial filling of the Lilla Bommens Harbour and of the Ring Canal, the removal of the Free Harbour railway station, etc., and it will also require the remodelling of the main traffic routes on both sides of the river.

Correspondence

NOTE:—The Editor assumes no responsibility for the opinions expressed by correspondents.

To the Editor of "The Dock and Harbour Authority."

Sir,

PORT PASSENGER ACCOMMODATION

Dr. Brysson Cunningham's observations on maritime passenger stations are of the highest interest not only to regular and occasional travellers to and from our shores, but to those of us—the great majority, let it be hoped—who ourselves appreciate the importance of "first impressions" and would wish to let visitors to our shores have favourable first impressions of Britain.

An obvious and outstanding fact is that all our seaports are the result of time's growth. They have not sprung up like mushrooms, whatever airports may be doing. As it is impracticable to pull down the buildings of the former *en masse* and, similarly, re-erect new port-buildings *en masse*, whatever is to be done must be done with existing buildings and without disturbing the continuity of their existing work and usefulness. It is a matter which demands the gravest consideration, and perhaps it is no bad thing that there is no little urgency attaching to the problem. Whether for good or evil—and, as I personally have a predilection for foreign travel, at the risk of being dubbed unpatriotic in neglecting home holiday-resorts, I think it is a good thing to see other lands when opportunity offers—maritime stations of this Kingdom are being increasingly used by week-end and "cheap return" passengers, incoming and outgoing. It would be a pity if the impression became general that "they do these things better abroad."

The "cheap-ticket" traveller, it may be, takes the philosophic view that, as he can go to Belgium, say, for no more than he would have to pay to go for his holiday to Cornwall, he must expect some sort of compensating inconvenience. Is there any need? If the rush at Dover, say, is so great when a heavily-laden boat arrives that the Customs, etc., cannot deal with it adequately, why advertise that so-and-so's tour will reach Victoria at such-and-such an hour, when it must be patent to the authorities that the train will be very late indeed? If the boat is so laden that a relief train be necessary, why put up some servant of the railway company to explain to passengers that the hasty improvisation of the train resulted in inability to have any light on during the run? Not a cheerful welcome home and not a good advertisement, for the unfortunate "improvisation" or "accident" compares unfavourably with the way in which "rushes" are coped with abroad.

Just one piece of constructive criticism. If the Customs, Passports and railway authorities cannot cope with a "rush"—which is often described as unexpected but which ought to be expected—at holiday time, why advertise the arrival of trains at hours to which the authorities know perfectly well they cannot conform? "Weather and other circumstances permitting" does not appear on the ordinary time-table applying to tickets issued in London for stations abroad. With some adaptation of old port-buildings, passengers would not reach their destination, half, three-quarters, an hour or more after the advertised time of arrival.

Yours faithfully,

G. B. J. ATHOE,
Secretary.

The Incorporated Association of Architects and Surveyors,
Westminster, S.W.1.

January 10th, 1938.

To the Editor of "The Dock and Harbour Authority."

Sir,

WAR-TIME PORT OPERATION

Mr. Ross-Johnson's article in your January issue is a very valuable contribution to the literature on the economic development of Ports and Inland Waterways.

Experience gained in the late War, and since, emphasises the importance of not congregating huge supplies near the seaboard, causing congestion in the transport arteries and at the ports where such stores can be readily destroyed in aerial attacks.

From practical experience over many years, I am convinced the Government would be well advised to take in hand immediately the development of Inland Waterways, from three points of view, viz., Transport, Land Drainage and Water Supplies.

The "Canal Cross" routes from London to Liverpool, and Bristol to Hull, should be sanctioned and brought under one authority, to enable through rates and transport to be established all over the country, and function rapidly without delay in negotiations.

The four main canal routes should be standardised to take 100-ton barges, which could then convey goods from manufacturing towns to the ports direct without transhipment. Flights of locks should be replaced by inclined planes on which the barges could be transported in cradles by electric haulage. The barges should be drawn along the canals by small electric locomotives.

In time of war, transport of munitions and foodstuffs would be effected with greater celerity and smoothness, both at the ports and inland. Ships could be discharged and loaded overside, away from the quays, as well as at the dock side; and all forms of transport, sea, road, rail and canal would be operated to maximum capacity.

There are numerous inland warehouses on and adjoining the waterways which could be utilised for the storage of munitions and foodstuffs to enable prompt shipment or discharge to be effected at convenient times, and so obviate huge vulnerable dumps being made at the ports. Such "Dumps" lead to waste of material, time and labour, and are not economical.

Yours faithfully,

G. E. WARBURTON.

"Hinaidi,"
St. John's Avenue,
Warley Mount, Brentwood, Essex.

January 24th, 1938.

Tide Gauges in the Port of London

By Commander E. C. SHANKLAND, R.N.R., F.R.S.E.,
River Superintendent and Chief Harbour Master, Port of London Authority

DURING the year ending December, 1936, approximately 62,000,000 net registered tons of shipping used the Port of London. Many of the ships in this total were deep drafted, proceeding to or from the Royal group of docks situated 40 miles from the sea traversing by night and by day a dredged channel on a rising or falling tide.

The tidal range in the waterway is considerable, varying from 15-ft. at neaps to 22-ft. at springs. The time lag of high water is about one hour between King George V. Dock and The Nore Light Vessel, which latter marks the seaward limit of the port. This time lag and tidal range enable the deeper-drafted vessels to navigate the estuarial channels, with a safe margin of draft provided the tidal conditions are studied. London, unlike Marseilles or Genoa, is prominently a tidal port, and the navigator using London River requires to study the tidal factors.

Tide gauges have existed for hydrographic purposes many years. For the pilotage of the deeper vessels special tide gauges have recently been installed. These several installations may be separated into three categories:—

1. Automatic gauges recording graphically the rise and fall of tide at suitable river stations, for hydrographic purposes.
2. Automatic gauges recording the artificially-controlled river or dock levels, as at Richmond Lock and Royal Albert Dock.
3. Visual natural range gauges for pilotage night or day, the visibility of the figures being about ¼ mile, showing to the navigator the changing tide level continuously.

The history of tidal recording in the Thames is disconnected but interesting.

Probably the earliest recorded attempt at tidal prediction refers to the Thames, found in the Codex Cottonianus Julius DVII, at the British Museum. This work contains calendar and other astronomical or geographical information, some of which are the production of John Wallingford, who died Abbot of St. Albans in 1213. At page 456 a table on one leaf shows the time of high water at London Bridge, thus—"flod at london brigge."

METAS LUNAE	h	m
1	3	48
2	4	36
3	5	24
—	—	—
—	—	—
30	3	0

In this table, column 1 gives the moon's age, columns 2 and 3 the time of high water corresponding to the age. It is evident from this table that the time of high water at London Bridge has advanced about one hour since the 13th century.

Flamsteed, the Astronomer Royal in 1683, friend of Isaac Newton, published a table giving times of high water at London Bridge, and so through the ages there have been tidal records of the Port of London. In 1800 Parliamentary powers were sought for the building of a dock adjoining the Pool of London when a statutory local tide level was fixed, named Trinity Standard. Observations were then made by a committee of the Trinity House under Captain Huddart. This Committee appear to have chosen the new moon of the 20th August in that year with a meridian passage of 10 hrs. 20 mins. a.m. G.M.T. The range of this tide was measured and found to be 18-ft. 3-in. below the level of the high water. This dimension was used for guidance in constructing the dock entrance, and a stone which commemorates and established this tidal reference exists near the Shadwell Dock at present.

Trinity Standard has come to be regarded as a horizontal tidal zero of approximately spring tide level throughout the river. The statutory declaration, however, clearly intended it to be of local application only, and it refers carefully to the adjustment necessary if applied to other parts of the river where the level and range would differ from the Pool of London.

Automatic gauges were apparently first tried at the Port of London in connection with further building operations for new docks. Old London Bridge, which acted as a dam to the Thames by reason of its many arches and piers, was removed in 1827 and the present one built. In order to obtain a continuous register of the changed behaviour of tide Mr. Palmer, the Engineer to the London Dock Company, established his automatic tide gauge there in 1831. Mr. Bunt, a few years later, produced a similar machine of his own design for the Port of Bristol.

In 1833 the Admiralty initiated what is now a world-wide practice by forecasting the tides of London, Sheerness, Portsmouth and Plymouth.

In 1892 the Thames Conservancy introduced a clockwork gauge to record the levels at Richmond Lock. This gauge made by Légé & Co. remained until 1923. When later the Port of London Authority was formed in 1909, greater attention was given to tide gauges due to the great waterway dredging scheme then contemplated. Approximately 55 million cubic yards of material in situ have since been removed from the river bed. This approximates in quantity to the first cut through the Isthmus of Suez.

The year 1912 saw several automatic gauges installed for the surveying and extensive dredging programme of the new Port Authority.

Automatic Tide Gauge.

Before proceeding to describe the automatic gauges erected by the Port Authority from 1912 onwards, a description will be given of the first automatic gauge invented by Henry R. Palmer, in 1831/33, when engineer to the dock under construction. The details were obtained from his paper read before the Royal Society of London by J. W. Lubbock (Phil. Trans. Volume 121, 1835). Its mechanism consisted of a float resting upon the water in a well, protected against tide undulations by wire gauze. The method of suspension was by chain passing twice around a light cast-iron vessel, and provided with a counter-weight. The chain of this counter-weight was of such a length that both ends were always resting on the ground. A light horizontal shaft with bevel wheels was geared to an upright shaft which acted on the pencil rack. The pencil moved backwards and forwards, making its impression on graduated paper held on a drum rotated by a clock. The cylinder carrying the graduated paper had on its axis a large toothed wheel which received its rotation from the clock shaft. To control the revolutions a cam wheel, having six teeth, then raised a hammer striking an impression once in every hour so that the spaces passed through were measured as they occurred obviating any error due to expansion or contraction of materials.

Mr. T. G. Bunt's tide gauge erected at Bristol on the tidal River Avon in 1837 followed similar principles, viz.:

An eight-day clock, turning a vertical cylinder revolving once in 24 hours.
A float rising and falling with the tide operating a pencil to scribe the tidal curve through special gearing.

The history of artificial estuarial development shows that as dredging proceeds in a narrow tidal river or as embankments are erected to confine the water to narrower limits, tidal changes occur. By dredging the River Tyne a deepening of 10-ft. was effected in about 50 years, thus the tide levels were changed considerably.

Tide Gauges in the Port of London—continued

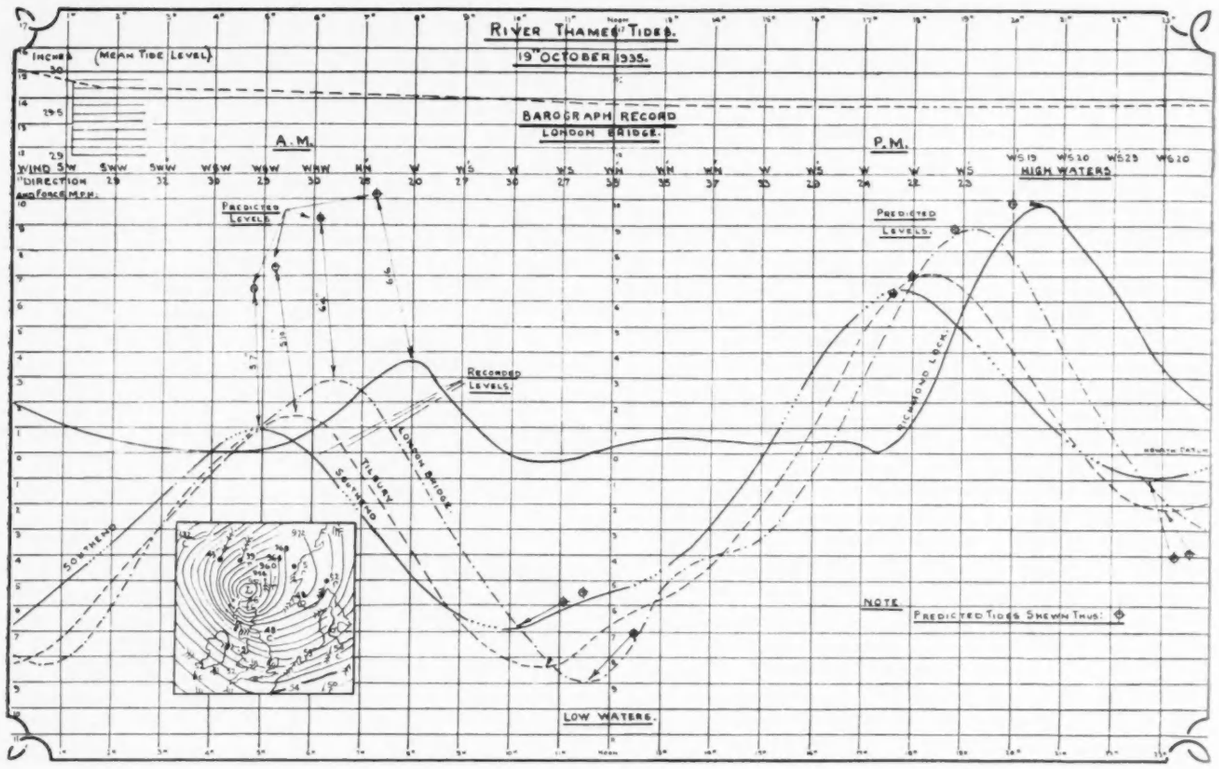


Fig. 1.

Likewise in the Port of London, above Gravesend, the range of tide has altered materially, due to widening and deepening the Channel over a period of 25 years. Embanking has also affected the tides by causing them to rise higher in certain parts of the waterway. We have therefore tidal complexity to consider.

Automatic tide gauges are essential to trace long period and short period effects. Mere recording of high and low water would not assist in tracing quarter-diurnal effects, for instance. These quarter-diurnals are very important in tidal research.

During the ten years preceding 1932, we found it necessary to frequently adjust our previous figures to obtain accurate tidal prediction. Harmonic Analysis has been employed for computing the times of high water at London Bridge from the earliest use of tidal forecasts, but the analysis primarily depends on a correct register of observations.

Recently the standard place for predictions was changed from London Bridge to the entrance of the port. It is now at Southend—where a tolerably free tidal wave exists.

At London Bridge the tidal wave in the form of a semi-diurnal rise and fall comes under the influence of several factors of a natural and artificial character.

1. When the Thames discharge reaches 10,000 million gallons per diem, the surface of tide at London Bridge may be raised 8-ins. by this fresh water layer.
2. When it reaches 15,000 million gallons the downstream flow retards the incoming tide wave, producing a false low water reading.
3. When the fluvial river is very low and the river bed dry the reverse conditions may arise to those mentioned in 2.

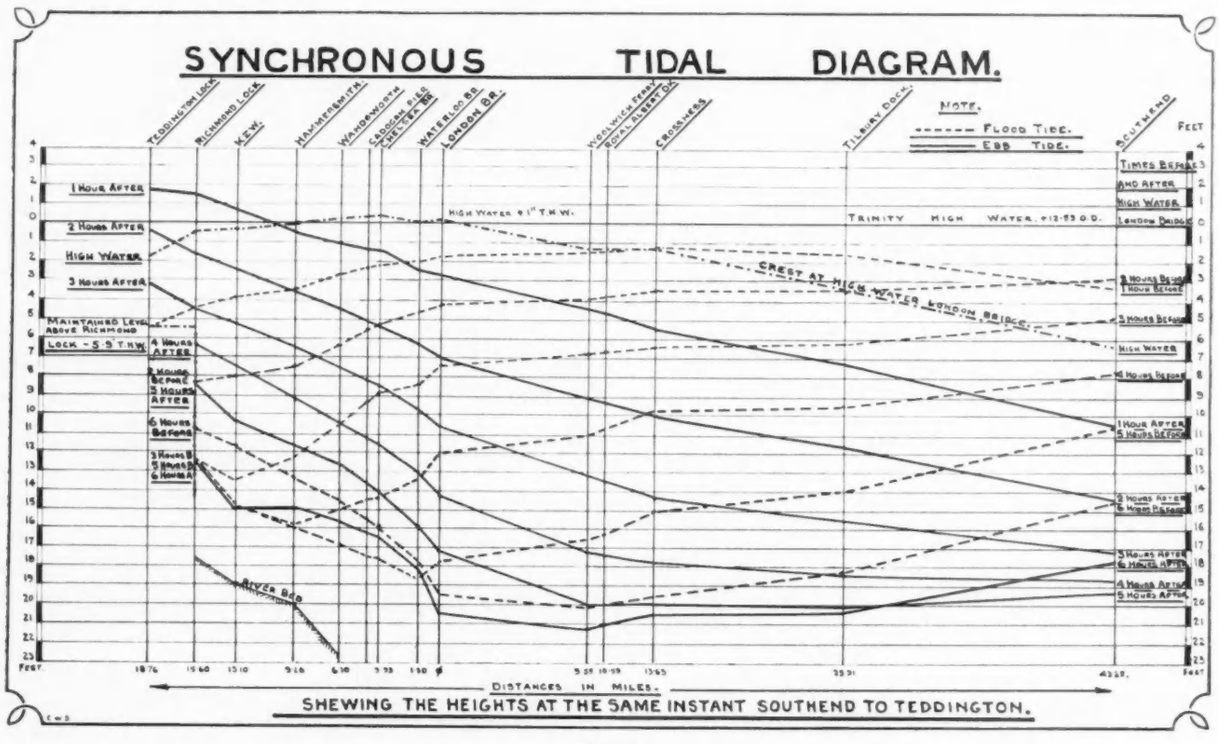


Fig. 2.

Tide Gauges in the Port of London—continued

In order to obtain normality, Southend-on-Sea was therefore adopted as the nexus of the tidal chain of predictions. Thus the Port of London tide tables have been revised to conform to the changed conditions.

Throughout the tideway occasional perturbations occur in a marked degree. These are invariably due to severe meteorological disturbances sometimes operating off the North-West coasts of the British Isles. The Straits of Dover appear to function as a sympathetic barrier to these tidal disturbances, and the Thames Estuary being in close proximity registers these local reactions.

Figure 1 is an example of these perturbations.

On 19th October, 1935, an intense depression travelled from the Atlantic, and on that date was centred over the North of Scotland (Fig. 1). The disturbance of the tidal levels in the lower part of the North Sea was such that the tide wave in the Port of London lost for a period its normal character with the effects seen on the curves.

The automatic tide gauge at Southend was made by Cary Porter, and established in 1912. It is of the horizontal drum type, the float operating the pen, the clock revolving the recording drum one complete revolution in 24 hours. The gearing reduces the tidal movement to a record of half an inch to one foot vertical, and one inch to the hour horizontal, the scope being equal to a tidal range of 29-ft.

The automatic gauges at Tilbury, 17 miles, and at Tower of London Pier, 43 miles respectively landward of Southend, are of the same design. The clocks which are lever type receive special attention, owing to vibrations which are inevitable from vessels manœuvring in the vicinity. At Galleons Reach, situated 33 miles landward from Southend, an automatic electrical recorder, established 1912, is fitted to show by remote control the variations of water level in the Tidal Basin with reference to the river levels. These diagrams are visible to the control engineer in the pumping station. Its arrangements consist, for the river levels, of a wooden trunk, 3-ft. by 3-ft., situated on the upper end of Galleons Jetty, a float having a diameter of 18-ins. is connected with a counter-weight by a copper wire passing over a grooved wheel, geared to a transmitter installed on the top and centre of the trunk. A unique feature of this trunk is the method of keeping it free from mud. The bottom consists of a flat iron plate pierced with holes, and moving over the plate, but in close contact is a steel wiper. To this wiper is attached a steel rod which runs to jetty level. The top end of the rod is squared to receive a key, and a few turns of this causes the wiper to move over the plate, forcing the mud through the holes in the bottom and preventing general settlement.

A movement of 2-ins. in the tide causes an electrical impulse to be transmitted along wires to the pumping station where the main instrument registers this rise or fall on the chart. Fixed to this instrument are two sets of induction coils, one for the rising tide, in which case the current causing the pen to move vertically to a scale of 2-ins. and vice versa for the falling tide.

A plate is fixed in the river trunk at a level of 5-ft. below T.H.W. Tidal contact with this plate causes a bell to ring in the pumping station, enabling the engineer in charge to check the accuracy of the gauge and to adjust as necessary.

For dock levels a similar transmitter, sets of receiving coils, float and counter-weight are used. The greatest fluctuation in dock level is 2-ft. 6-in., compared with the maximum river range of 30-ft. The distance of the transmitter from the pumping station in the case of the river levels is some 600-ft., and in the dock level the distance is nearly half a mile.

Both the river and dock levels are recorded on the same tidal sheet, which is fitted on a drum which revolves once in 24 hours and the record is changed daily. The drum is of the vertical type and consequently the pens move vertically.

The voltage used to operate this gauge is 20 volts, and is supplied by a battery of 14 Léclanché cells.

From 1912, the date of installation of this gauge, to the present time, a chain passing over a sprocket wheel was used to link the float and counter-weight to the tranmitter, both in the case of the river levels and dock levels.

Considerable trouble was experienced by the stretching of the chain, but this chain has now been replaced by a flexible copper wire which is wound round a grooved wheel.

Non-Harmonic Constants

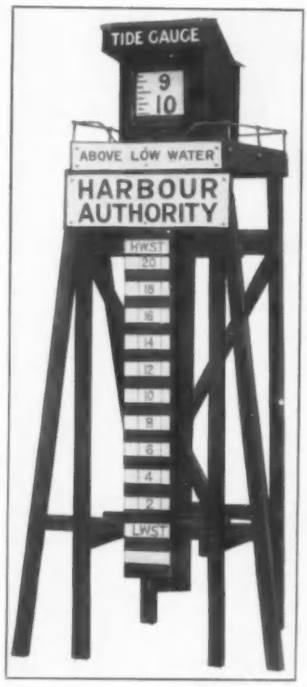
For determining the non-harmonic constants we have recently examined the tidal slope at several points of the river from synchronous readings of the automatic gauges. From this diagram the position of maximum range of tide is demonstrated as existing at Woolwich.

Moreover, it will be observed that the face of the Tidal Thames is more frequently a changing sinuous surface than a direct slope. (Fig. 2).

Pilots' Gauges

The delicate clockwork mechanism of the automatic gauge does not lend itself to long-distance signalling of large figures to show the rise and fall by day or night, which are essential for pilotage.

In several ports the rise and fall at important points in a long tidal river are shown by distant signals, such as in the River Hughli.



In the Port of London we established in 1924 a pilots' day and night gauge, which consists of 12-in. figures on a frame passing through an illuminated box. The frame is on vertical rods secured to a barrel-shaped float. The gauge is erected on an existing quay. It has been found desirable to build a protection around the float to reduce the vibration caused by the waves from passing ships.

This gauge was so successful that it has been repeated at Tilbury Pierhead, eight miles downstream, where ocean liners pass up and down the river under varying conditions of weather night and day. The Tilbury gauge is also within visual range of the Passenger Landing Stage where liners arrive and depart.

These 12-in. figure gauges for pilotage can be seen by the naked eye from mid-river under normal conditions of visibility.

Demonstrations have recently been made of a high visibility day and night gauge operating figures 3-ft. in dimension. These figures are shown on a screen by a method similar to electrical advertisement signs. It may therefore be called a monogram tide gauge. The tidal movement is transmitted by a float to a rotary drum suitably geared. A series of selecting keys which light the group lamps are engaged by the drum in its rotation. On the screen there are, for the Thames range, 46 electric light lamps fitted with prismatic reflectors. The controller drum is constructed so that the selective switches cannot poise between any two display positions, so that when the figures are changing from, say, 15-ft. to 16-ft. there is no illumination.

In sunshine this sign can be seen as far as at night, which is approximately one statute mile in clear weather.

The electrical character of the mechanism does not, however, confer the boon of cheapness upon the monogrammic type of gauge.

Publications Received

Port Series No. 1—Portland, Maine.

A copy of a report on Portland, Maine, compiled by the Board of Engineers for Rivers and Harbours, War Department, and the United States Maritime Commission, and published as Port Series No. 1, has just been received. The report is a revision of the data published in previous issues, and gives information with regard to port and harbour conditoins; port customs and regulations; services and charges; fuel and supplies; and the facilities available for service to commerce and shipping, including piers, wharves, grain elevators, storage warehouses, bulk freight storage, dry docks and marine railways, marine repair plants, floating equipment, and wrecking and salvage facilities. Railroad and steamship lines are reviewed and information given regarding their charges and practices in connection with terminal service. Tables are presented, showing in detail the foreign and domestic water-borne commerce at the port during the period 1926-35. Information is also given showing the origin of imports and the destination of exports, as well as the origin and destination of intercoastal traffic during the calendar year 1935.

Tide Tables for British Ports.

The London and North Eastern Railway Company announce that Tide Tables for 1938 have been issued, and may be obtained free from the Portmaster at the port concerned. The Tables are bound in three volumes of a handy size for the pocket, and contain information regarding high tides, depth of water, phases of the moon and accommodation available at the various docks. The volume deal respectively with: Middlesbrough Dock, The Hartlepools, and Hull, Immingham and Grimsby.

Foreign Trade Zone Developments at United States Ports*

Being Section III of the Report of the Committee on Foreign Trade to the Twenty-sixth Annual Convention of the American Association of Port Authorities, held at Wilmington, Del., October 12-15, 1937

By G. H. POUDER, Chairman

The subject of foreign trade zone establishment at United States ports, under the Foreign Trade Zones Act of 1934, was discussed at length in the 1935 and 1936 reports of this Committee. The theory of this operation, and the limitations and restrictions of the present law, will not be again dealt with in this report.

During the past year your Committee has endeavoured to keep in touch with the foreign trade zone situation, holding numerous conferences with the Secretary of the Federal Foreign Trade Zones Board in Washington, and corresponding from time to time with ports which contemplated the establishment of zones. Engineers active or interested in making surveys for free trade zone establishment also conferred with your Chairman, and numerous inquiries were answered as to the status of the movement.

The present national situation in respect to foreign trade zones is as follows:—

(1) The first American foreign trade zone, located at Staten Island, New York City, is now in operation, under the jurisdiction of the Department of Docks, City of New York.

(2) The Port of Mobile, through the Alabama State Docks Commission, has been authorised to establish and operate a zone.

(3) Application has been made and hearings held in respect to the establishment of a zone at the Port of San Francisco, which establishment it is reported has been refused, with opportunity offered for further submittal by San Francisco interests to conform more closely to the requirements of the Act.

(4) Examinations or applications for foreign trade zone establishment are pending in connection with the ports of Los Angeles, Seattle, San Juan, Puerto Rico, and Jersey City, N.J.

First Foreign Trade Zone Open

Foreign Trade Zone operation in the United States in 1937, and since the last convention of the American Association of Port Authorities, was featured by the opening on February 1st, 1937, of the country's first zone at Stapleton, Staten Island, constructed at a cost of approximately $850,000. Opening of the zone was originally set for November, 1936, but postponement until February 1st, 1937, was granted by the Foreign Trade Zones Board. The zone, which originally comprised piers 12, 13, 15 and 16 at Stapleton, and 25 acres of adjacent land, enclosed by 10-ft. wire barrier, is owned and operated by the City of New York. In addition, the municipality dredged a 30-ft. channel alongside piers 12 and 13, and future plans were laid for channel improvement alongside piers 15 and 16, and the installation of a sprinkler system.

Although a number of inquiries were reported by Dock Commissioner McKenzie of New York, little business was handled by the Foreign Trade Zone at Staten Island immediately following its official opening. This situation caused a temporary withdrawal of customs guards about six weeks after the formal opening. One early feature of this situation was complaint by operators of foreign flag vessels that they could not make use of the free zone as a place of storage for vessel supplies or equipment, for loading aboard vessels, without payment of duty, because use or consumption aboard such vessels would not be considered a bona fide exportation.

Recommendation that the City of New York cease operation of its foreign trade zone and turn this over to a quasi-public authority, was made in a report to Mayor LaGuardia by the Mayor's Advisory Committee on April 9th, 1937. The report was presented by Lewis J. Comstock, Chairman of the Committee, and President of the Merchants' Association of New York, who pointed out that present federal rules are too rigid to permit the zone's profitable operation. Attached to the report was an offer by E. Ponchelet, New York importer, contracting to operate the zone with a $100,000 corporation, to be increased to $250,000 in two years, subject to the condition that the city handle the physical end of the operation.

The adoption of a contract between the City of New York and a Foreign Trade Zone operating company has been opposed by various organisations, largely on the ground of possible excessive outlay on the part of the city without assurance of even a moderate return on the investment. Action by Mayor LaGuardia and the New York Board of Estimate has been postponed, although a special committee recommended acceptance of the operator's bid and the inclusion of a proposed contract between the city and the private operator. The city would be required, according to information resulting from a hearing before the Board of Estimate, to set up an operating fund not to exceed $130,000 per year to pay operating expenses. Organisation expenses would be met by the private corporation, while the city would pay emergency construction requirements through a $250,000 construction fund. The corporation would receive 30 per cent. of the gross revenue up to $300,000, 35 per cent. of the $200,000, and 40 per cent. of the gross in excess of $500,000. At the time of drafting this report (September 8th, 1937) the contract had not been approved.

Efforts to interest export and import concerns in Foreign Trade Zone No. 1 are being currently undertaken by the New York Dock Commission. Circulars in question and answer form, pamphlets and posters, have been distributed, and a more vigorous effort is being made to attract business. A comprehensive booklet entitled "Foreign Trade Zone No. 1," was recently issued on the general subject by the New York Department of Docks.

Dock Commissioner's Views on New York Zone

What New York's foreign trade zone at Staten Island has accomplished toward the development of new foreign commerce for the Port of New York in the six months of its active operation, and what is needed to make it a success, was outlined by Dock Commissioner John McKenzie before a meeting of the Traffic Club of New York at the Hotel Biltmore, September 23rd.

[Mr. McKenzie's address was published in the December issue of this Journal, and accordingly is not reproduced here.—Ed.]

American Foreign Trade Zones, Inc.

Considerable discussion on foreign trade zones was carried on in the New York press in the late spring of 1937. The advantages of zone operation being maintained by James S. Mahool, Vice-President of the American Foreign Trade Zones, Inc., which has been authorised by the New Jersey Legislature to establish a zone in the Greenville Section of Jersey City. This was the first zone application. Formal application of the Board has thus far been withheld, pending examination and hearing.

Early in February, 1937, the New York Board of Trade had registered its opposition to a competing foreign trade zone on the New Jersey side of New York Harbour, on the ground that it would unduly compete with the zone at New York.

Port of Mobile Zone

A hearing was held by the Foreign Trade Zones Board at the Port of Mobile on May 5th, 1937, to consider the establishment of a zone on Pier A-South, and adjoining structures and land acres of the Alabama State Docks Commission. The application was approved on September 22nd, 1937, after certain additional requirements of the Board had been met. It was developed at the hearing that the estimated tonnage for the zone would be 15,000 short tons the first year, a 33⅓ per cent. increase in the second year, twice the amount of the first year in the third year, and thereafter a 10 per cent. increase. C. C. Kirkpatrick, special assistant to the Dock Commissioner of Mobile, stated that Tennessee Coal, Iron and Railway Company is constructing a new plant at Birmingham, Ala., and would move 200,000 tons annually via Mobile. In the Foreign Trade Zone Board's official announcement of this grant on September 22nd, it was pointed out that there is no provision in the law for the expenditure of federal funds in connection with the construction, equipment or operation of a foreign trade zone, that the project will therefore be financed by the Docks Commission of Mobile. In this announcement the Federal Board also pointed out that the New York Zone, according to a report received from the Commissioner of Docks, is now handling a variety of commodities, and that an increasing number of requests for information have been received.

New business, which it is anticipated will be attracted to the Port of Mobile by the new zone, includes: Wines and liquors, olives and olive oils, seeds, cement, hides and skins, refined sugar, tobacco and manufactures, chemicals, rice, china ware and vegetable oils. The zone will be operated as a public facility under Federal supervision, and will be provided with all necessary facilities for loading, unloading, storing and manipulating goods.

Port of San Francisco Zone

On April 28th, 1937, an Examiner's Committee hearing was held in San Francisco, regarding an application previously held by the Board of State Harbour Commissioners for a grant to establish a foreign trade zone at Pier 45 on the San Francisco waterfront. Shippers using the Port of San Francisco stated

* Better known in Europe as "Free Ports" or "Free Port Zones."

Foreign Trade Zone Developments at United States Ports—continued

that the zone would be of particular value in connection with increased transhipment and re-export trade. Little opposition developed among replies from 500 shippers, 98 per cent. of them favouring the establishment of the facility. Unofficial reports are to the effect that the San Francisco zone application was disapproved in September, 1937, with opportunity offered for re-submittal of the proposal under other conditions conforming to existing law.

New York Warehousemen's Association

The Warehousemen's Association of the Port of New York in May, 1937, registered opposition to foreign trade zones, claiming that bonded warehouses at that port afforded ample space for the requirements of imports and provided for all operations provided in the zone, at more convenient locations. The Warehousemen's Association pointed out that during the first few months of operation of the Staten Island Zone only a few packages of imported merchandise, totalling in value slightly over $13,000, were stored there.

Objections registered by the Warehousemen's Association included:—

(1) Lack of revenue would not permit of full foreign trade zone operation or permit a return on the city's investment of $850,000;

(2) facilities duplicated those of the bonded warehouses;

(3) location of zone on Staten Island was difficult of access, and not adjacent to various steamship lines located along New York's 76 miles of waterfront and New Jersey's 148 miles of waterfront;

(4) at least 90 per cent. of import merchandise arriving in New York is intended for American consumption and less than 10 per cent. is intended for processing and exportation. This 10 per cent. or less has for years been handled in the various bonded warehouses scattered throughout New York in locations which are most favourable for imports.

Los Angeles, Seattle and San Juan

The Port of Los Angeles is currently investigating the need for a foreign trade zone. C. C. Kirkpatrick, who made zone surveys for the ports of Mobile and San Francisco, is examining the desirability of such facilities at the Port of Seattle. The Seattle Port Commission states that it is awaiting the outcome of the survey before considering an application for permission to establish a zone. No action has as yet been taken by the Foreign Trade Zones Board on the application of San Juan, Puerto Rico, pending since 1936.

Canadian Free Port Bill

Canadian sentiment has differed on the need of foreign trade zones in that country. Five Canadian business and trade associations disapproved a proposed Free Port Bill in the Canadian Parliament, with only one city, Victoria, urging such legislation. Proponents pointed out that a free port on the Canadian Pacific Coast would provide Great Britain and her Dominions with a means of marketing British goods on the West Coast of North America, as well as inland. Although the legislation passed the upper Canadian Chamber and received first reading in the Commons in 1936, it was held up at a third reading in the Senate in 1937, and was sent to the Banking and Commerce Committee. Opposed to the Bill was the Canadian Manufacturers' Association, the Canadian Chamber of Commerce, and the Boards of Trade of Montreal, Toronto and Vancouver. The opposition argued that present Canadian bonding arrangements were satisfactory, and that the introduction of free ports would tend to duplicate existing facilities. The Bill would permit one free port zone in each Province, upon recommendations of a city of the Province.

Zone Developments Overseas

Developments in leading overseas free ports, or foreign trade zone establishments, during the past year, have included:—

(1) Steps to revive the commerce of the Free Port of Fiume by a special Italo-Hungarian Commission. The first step was taken in October, 1936, when all Hungarian live-stock exports were routed through Fiume.

(2) Study of the possibility of creating a free port at the Port of Genoa. It is expected that the zone will be authorised in the near future. Maritime and trading interests believe that traffic with the interior foreign hinterland will be increased by the use of a zone, and that a considerable volume of trade would be developed with southern Germany through Genoa.

(3) Negotiations are being carried on by Czecho Slovakia relative to the construction of a large warehouse in the Hamburg Free Zone, because of increased movement of merchandise consigned direct to and received from American and British firms.

(4) Effective November 1st, 1936, a Free Zone was established at the Port of Alexandria, Egypt. Within three months it was found that the area was not sufficient for the requirements of intransit trade and a new and larger site was selected. A number of applications have been made to rent sites in the Zone as Egypt becomes more important as a focal commercial point in the Near East.

(5) Establishment of free trade zones in France and the French colonies was advocated by a Bill introduced in the French Parliament late in 1936, approved by the Committee on Merchant Marine in the Chamber. The Bill was not finally enacted.

(6) The Copenhagen Free Port in its balance sheet for 1936, the 42nd year of the port's existence, showed a slight increase in income. Increased imports of grain and foodstuffs were reported as a result of the poor harvest in Denmark, in addition to increased imports of coal, coke, fuel oil and gasoline. General cargo traffic decreased.

(7) What is reported by Hamburg shipping circles to be the largest transfer and distribution shed in Europe, was opened on June 3rd, 1937, in the Hamburg Free Port. It covers 32,000 sq. metres.

(8) A dispatch from the American Consul at Ensenada, Mexico, reports that the establishment of a free zone at that point in December, 1933, has been the principal factor contributing to the business growth and development of the port.

Question of Manufacturing

The basic American foreign trade zone law, under which present establishments are being considered, prohibits manufacturing in a foreign trade zone. Although Congressman Celler, of New York, advocate of foreign trade zone establishment in the United States, stated last year that an effort would be made to amend the law, permitting manufacturing at a zone, no action along these lines was taken at the last session of Congress.

Your Committee has no specific recommendations to make in respect to this general question. It is obvious that foreign trade zone establishment in the United States is still in the experimental stage, and the New York experience of less than a year has not yet furnished a basis to determine the feasibility of the operation. Applications have been slow, due to proper care in preparation of surveys and studies, and the exacting requirements of the law. The question of manufacturing in foreign trade zones is still the principal point of controversy, and will undoubtedly receive active consideration, as the general subject grows in importance.

Despite predictions and claims made by various ports in connection with present or prospective foreign trade zone establishments, the practical advantages of this movement under existing law, have by no means been determined. At least another year will be required to see this picture more clearly, and your Committee will observe it, if the Association desires.

Record Year at Southampton Docks.

Several important new records were established in the shipping trade at Southampton Docks during 1937, and the measure of progress made generally was greater than had been experienced for some years past. Official statistics now available show that the total amount of shipping which entered the docks during the period under review reached a figure of no less than 19,520,994 gross tons, exceeding the previous highest aggregate by nearly one million tons.

More cargo and passengers were dealt with than in any other post-war year, and, so far as the latter traffic was concerned, the total of 621,000 passengers which embarked and disembarked at the docks created a new record. More than 250,000 passengers were conveyed to and from Southampton by the Southern Railways Company's cross-Channel services. Both the cross-Channel and ocean passenger movements were substantially greater than in the preceding year.

An advance of approximately twelve per cent. was registered in the volume of freight handled, both imports and exports contributing to the increased aggregate which reached 1,300,000 tons, and was the highest of any post-war period. Imports, in fact, attained a higher level than ever before, the principal increases being in timber, fruit, grain and sugar.

Much of the progress achieved at Southampton in 1937 was made possible by the additional accommodation for shipping provided by the recently completed Docks Extension Scheme at the port, and it is interesting to note that since the Scheme was initiated in 1927 the tonnage of ships using the docks has advanced by 25 per cent.

Southampton, which now ranks as the third largest port of the United Kingdom, judged in terms of the quantity of shipping entering annually, will, on the 12th October, 1938, celebrate the centenary of the laying of the foundation stone of the Docks Undertaking, and arrangements are being made for the event to be suitably commemorated.

Notes of the Month

Manchester Ship Canal Appointment.

Mr. Norman N. Bird, F.C.I.S., has been appointed assistant superintendent of the Bridgewater Department of the Manchester Ship Canal Company, as from 1st January, 1938.

Opposition to Corporation Harbour Bill.

Two meetings, one at Emsworth, Hants., attended by yachtsmen, and another at Bosham, Sussex, attended by local fisherfolk, have recently been held to discuss the Parliamentary Bill promoted by the Chichester Corporation for acquiring powers over Chichester and Bosham harbours. At both meetings it was decided to present petitions against the Bill.

Increased Trade at Sierra Leone Ports.

A Colonial Report on Sierra Leone states that the number of steam and motor vessels entering the ports of the Colony during 1936, increased by 8, and the increase in tonnage was 88,389 tons. Of a total of 2,485,750 tons entered, 66.58 per cent. was British, 8.91 German, 3.13 Italian, 5.73 French, 6.25 American, and 5.72 Dutch. The total value of imports into the Colony amounted to £1,346,715, compared with £1,214,315 for 1935. The total value of exports amounted to £2,376,965, compared with £1,583,834 for the previous year.

Dry Dock to be Constructed in Mexico.

The construction of a large dry dock for repairing merchant and war vessels is to be undertaken in the near future at a port in the Gulf of Mexico best suited to the purpose. The Ministry for Communications has been granted the sum of 1,000,000 pesos for the project, and has commissioned engineers to ascertain the most favourable location for the dock. The sites suggested are Tampico, Vera Cruz, Campeche City or Progresso, and it is hoped the dock will be ready for service at an early date.

Trade Returns at Oslo.

According to the annual report of the Port of Oslo Authority, record figures were attained during the financial year 1936-37. Calls were made by 3,109 foreign-trade vessels of an aggregate of 5.4 million gross tons, and by 28,975 ships (4 million gross tons) engaged in home services.

The amount of goods imported via the port of Oslo totalled 1½ million metric tons, while exports aggregated about 452,000 tons, these figures being the highest on record in the post-war history of the port.

The Northern Sea Route.

The Central Administration of the Northern Sea Route celebrated its fifth anniversary on December 17th. This body was instituted by the Soviet Government for the purpose of establishing a great northern sea route from the White Sea to the Bering Straits, and of equipping the route in a way to ensure safe navigation. In 1934 the final preparations were made for the organisation of shipping services, and in 1935, 100 vessels sailed over the route carrying a total of 230,000 tons of freight. In 1936, the number of vessels increased to 160, and the provisional figures for the 1937 navigation season indicate a still further increase. Fifty-seven Arctic stations have been established in the far north, and a number of radio stations have been created, which play an important part in the work.

Proposal for New Customs House at Liverpool.

At a meeting of the Council of the Liverpool Chamber of Commerce held recently, it was suggested that the Customs House site in Canning Place, Liverpool, shall be utilised for the purpose of a fish market, and that a modern Customs building should be erected near the Dock Office. The present Customs building is a hundred years old, and is unsuited to modern requirements. The matter was referred back to the Executive Committee for consideration.

Newport Harbour Dues.

The Newport Harbour Commission have recently had under consideration a proposal that the 20 per cent. allowance in harbour dues should be discontinued. On behalf of the Newport Shipowners' Association, it was contended, at a meeting of the Commission, that despite the trade depression, the Board had been able to meet their expenses out of revenue, and it had not been necessary to draw on the reserve fund. It was urged that it was not advisable to levy heavy dues, as Newport was in keen competition with Liverpool in general cargo trade, and the Mersey Docks and Harbour Board had reduced their dues. Representatives of the Shipbrokers' Associations also propounded similar views, and after discussion, the question was referred to a sub-committee for consideration.

Suggested Improvements at Glasgow Harbour.

Further improvements at Glasgow Harbour to facilitate the quicker handling of increasing incoming cargoes of scrap-iron, iron-ore, and pig-iron were forecast at a recent meeting of the Clyde Navigation Trust. Trade at the port continues to improve, and the tonnage of vessels for the last six months was 8,284,000 tons, an increase of 255,000 tons, compared with 12 months ago.

Record Cargo Handling at Workington.

The 10,000-tons S.S. "River Afton," owned by the Ayrshire Navigation Co., Ltd., Newcastle-on-Tyne, carrying 9,500 tons of ore from Pepal, Sierre Leone, West Africa, arrived on Sunday night, January 16th, at Workington Dock, started to unload at 6 a.m. on Monday, January 17th, and was cleared by mid-day, Friday, January 21st, and sailed on the afternoon tide of the same day. This is the largest steamer cargo ever taken into Workington Dock, and the speed of unloading is believed to be a record for that dock.

Improved Harbour Revenue at Whitehaven.

It was announced at a meeting of the Whitehaven Harbour Board that for the first time in two years, full half-yearly interest is to be paid on all classes of Harbour Bonds. This is the result of increased revenue following the re-opening of the Whitehaven coal mines last April. The harbour derives the greater part of its income from coal shipping. Work on the harbour improvement scheme, which is being assisted by the Special Areas Commissioner, will commence almost immediately. The scheme, which includes the provision of new dock gates and the deepening of the entrance, will cost about £30,000.

Sale of Port-Glasgow Harbour.

The Port-Glasgow Harbour Trust has agreed to accept the offer of £3,000 made by the local town council for the purchase of the entire harbour undertaking. The area includes the dismantled shipyard formerly occupied by Messrs. Lithgows, Ltd., and the first graving dock constructed in Scotland. The harbour is being acquired by the council for incorporation in a town improvement scheme. The purchase price does not include the annual ground rents which are retained by the trust.

Development of Igarka, U.S.S.R.

The last ships of the season have left the Siberian port of Igarka, with timber for Soviet and foreign ports. The port has, since 1929, become one of the largest on the Northern Sea route, and in volume of freight turnover it is the second largest port in the North, the port of Murmansk being the first. Although it is situated on the Yenisei, 750 kilometres from the Arctic Ocean, it ranks as a seaport, for the Igarka Channel has a depth of from 12 to 13 metres, and permits the entrance of large ocean-going vessels. A wharf has been built of sufficient capacity to enable the loading of 10 large vessels to be undertaken at the same time.

Entrance Channel to be Dredged at Tayport Harbour.

It is announced that the London and North Eastern Railway Company, the owners of Tayport Harbour, have informed the Tayport Town Council that arrangements have been completed for dredging the entrance channel. Several vessels have run aground during recent months, and fears have been expressed that the port, which handles a substantial traffic in esparto grass, wood-pulp, timber and china clay, would become inaccessible. The decision has been delayed as the result of a difference of opinion between the railway company and Dundee Harbour Trustees, the pilotage authority, as to the responsibility for keeping the channel clear.

Improvements at Montreal Harbour.

Schemes involving the expenditure of nearly 3,000,000 dollars have been approved by the National Harbours Board of Canada, for the Port of Montreal. The work on improving the downstream side of Alexandria Pier, to bring Sheds Nos. 4 and 6 into line, with the upstream side Sheds Nos. 3 and 5, is now in hand. Decayed timber work on the west side has been replaced by concrete aprons, and more are to be erected on the east or downstream side. The wharf below Sutherland Pier, extending east, down towards Vickers, is to be raised to high level, thus giving a deep-water frontage of 1,500-ft. This part of the project will cost several hundred thousand dollars, and is to be commenced in the spring. Another improvement will be the extension of the McColl-Frontenac Pier (situated at Montreal East) a further 700-ft. eastwards. At Windmill Point, the downstream end of the pier on the north side is to be repaired and brought up to date. Substantial dredging operations are also contemplated.

The Economic Future of Canals

By GEORGE CADBURY, M.Inst.T.

A Paper read before the Institute of Transport on December 13th, 1937

THE future of our inland waterways is of great importance to industry in this country as an alternative to road and rail. The question which is constantly being asked is whether these waterways are likely to survive or, if not, whether the State should come to their aid. Before answering this question we must look at the similar position of road and rail. Turnpike trusts came to an end soon after the railway era began because the income from tolls was insufficient to support them. But roads were far too important to be allowed to go out of repair, so the local authorities took them over in the public interest. Railways are now passing through a similar phase, but it is unthinkable that the Government could allow them to reach a state of bankruptcy. In the same way canals have struggled to maintain their independence with very little public support, and the fact that many of them still function is a tribute to their vitality. Continental countries treat them as highways for the benefit of the whole community, and the Royal Commission on Canals and Waterways of 1906 recommended that our waterways should be toll free. It is time that their position was examined from the point of view of a necessary public service. In doing so, we must clearly distinguish between the waterway and the traffic which travels on it. Just as the State and local authorities maintain the roads but tax the user, so we must consider the position of the oldest highway of all, the rivers and estuaries and their modern extensions, the artificial canals, and examine their function in modern life. This is what I mean by the economic future of canals, using the word "economic" in its broad sense and not in the strictly narrow sense of return on capital.

General Characteristics of Road, Rail and Canal

Perhaps I may be permitted briefly to describe the characteristics of the three common forms of transport—road, rail and canal—and with a view to placing the subject in its proper perspective to quote a few elementary statistics. Excluding all waterways which carry less than 10,000 tons of traffic per annum, the mileage of canals and inland navigations in active use in Great Britain for which traffic statistics are published by the Ministry of Transport is 2,020. Of these, 836 miles are either owned or controlled by the railways, and 1,184 miles are independent. There are also some 1,260 miles of rivers and navigations, but many of these are used primarily for irrigation purposes and others are unnavigable, so that it is difficult to say exactly what is the net mileage of inland waterways effectively available for traffic. There are 20,120 miles of railway excluding sidings, etc., and 43,870 miles of classified roads. The mileage of unclassified roads is much larger, amounting to 134,233 miles, but these are either streets in towns or else secondary roads in country districts, neither of which can be regarded as competitive with railways or canals.

The tonnage carried by the railways in 1936 was 300,580,000, whilst the waterways carried just over 11,000,000 tons. The tonnage figures for road traffic are naturally not available. In the case of the railways, official statistics are published showing the number of ton-miles conveyed per annum, but comparable figures for the waterways cannot be obtained.

The main characteristics of water transport as against rail are that each boat is a unit free to travel in any direction and at any speed and to halt for loading or unloading at any point on the waterway, whereas railway wagons can only travel in trains hauled by an independent locomotive along a predetermined route, and required to fit in with other trains as to speed and timing, and unable to stop at intermediate points on the line. This freedom on the waterways is comparable to that of road vehicles on the road, and the mobility so obtainable is of great importance in securing direct unhindered transit from point to point. The power required to haul a given load is much less at moderate speeds on water than on road or rail because of the absence of friction and of steep gradients.

These elementary conditions are fundamental to the consideration of the subject because they govern the economic use of waterways as against road and rail. It is undoubtedly these factors which have enabled canals and rivers to maintain their position in face of keen competition and even opposition of other forms of transport.

The Question of Costs

In examining this question every student of transport operation will know how impossible it is to give exact costs; there are so many variables and overheads to be distributed which can only be done by approximation. It would probably be true to say that every consignment would show a different cost and, therefore, costing can only be in very general terms. In making rates many things enter besides costs as, for instance, the regularity of the flow of traffic, the volume between any two points and the character of the goods handled. It is difficult therefore to try to compare the costs of handling the same traffic between any two points over a period by two different methods, although the cost of any single consignment may be fairly closely approximated. However, it is essential if traffic is to be carried at a profit to adopt some system of costing. In the Severn and Canal Carrying Company we work back from the balance sheet and endeavour to cost each boat journey and so arrive at a basic cost per boat-load, and from this we can arrive at costs for goods in less than boat-load lots; these costs take into account transhipment and intermediate warehousing as well as general overheads. By this means, we believe we have established a system on this waterway which provides an adequate safeguard against the quotation of uneconomic rates—always the cardinal danger which transport undertakings have to avoid. There has been a tendency in all three forms of transport—road, rail and water—to attract large tonnages at almost any cost in competition, the feeling being that somehow overheads will diminish and the actual running costs not correspondingly increase, but the actual incidence of each of these has been unascertainable. The only final test, of course, is the annual balance sheet of the transport undertaking, but the results on road and rail are often complicated by bringing in passenger transport.

Although I have examined several typical actual costs and compared them, I have not felt that there is sufficiently reliable evidence upon which to base a serious argument for or against the economic value of canals, although undoubtedly the general trend of such evidence is in favour of the waterways.

Continental Experience

My approach to the subject, therefore, must be more indirect, and I wish to begin by looking at the general position on the Continent.

The Royal Commission of 1906 pointed out in their final report that the most striking difference between England and the Continent is the extent to which the waterways in Continental countries—in common with the main roads, bridges and seaports—are under the direct control of the central government, whereas in England they are managed by a large number of different authorities, each pursuing a policy which is independent and sometimes in conflict with those of the remainder. This distinction is so fundamental that it outweighs the geographical and physical differences, important though the latter admittedly are.

I do not intend to recapitulate the arguments of the Royal Commission at any length, but as they are as true to-day as when they were first set out thirty years ago, they are perhaps worthy of a brief summary.

The Report of the Royal Commission

In the first place, the Royal Commission fully admitted the substantial natural advantages enjoyed by Holland, Germany and, to a somewhat less extent, Belgium and France, over this country. The most important of these is the existence on the Continent of over a dozen large rivers which far exceed in length, depth and suitability for navigation anything of which this country can boast. Some of these, like the Rhine, the Danube, the Elbe and the Vistula, are international highways; others, like the Seine, the Loire and the Weser, are under exclusively national control. The methods by which these rivers are administered vary considerably in detail, but as a general rule the principle is observed that navigation of them is free to all comers, and that the cost of their upkeep is borne by the State or States within or along whose boundaries they flow.

The second natural advantage enjoyed by the Continent is the much larger extent of flat or relatively flat country, which means that fewer locks have to be constructed for a given length of canal. This advantage is particularly noteworthy in Holland, North Germany and North-west Belgium. The Canal du Centre in Belgium, on the contrary, which runs from Mons to a junction with the Brussels-Charleroi Canal, has a fall of 294-ft. in its length of 13 miles, and will nevertheless take the standard 300-ton boats which navigate throughout the Belgian canal system. This is a fall of 22.6-ft. per mile, which may conveniently be compared with the height of 8.46-ft. per mile

The Economic Future of Canals—*continued*

overcome on the Birmingham-London route, or even that of 13.8-ft. per mile between Birmingham and Worcester. In Germany, the Main-Danube Canal and Friedrich Wilhelm Canal have falls of over 8-ft. per mile. The former of these is 110 miles long, and takes boats of 125 tons burden; the latter is 8 miles long, and takes boats up to 300 tons. These examples indicate that it is possible to exaggerate the flatness of the country in certain parts of the Continent through which canals have been constructed.

A third natural advantage, though of an economic character, which has been claimed for the Continent is the greater need for cheap inland transport in countries whose industrial areas are much further from the sea than are those of Great Britain. It is argued that an island with numerous ports, from one or other of which none of the principal manufacturing districts is very far removed, can afford to dispense with the artificial waterways which are essential to Continental manufacturers and traders. This argument would carry more weight if it were not for the fact that rates from the sea-board to Continental centres more distant from a port than any part of Great Britain are actually lower than those by either rail or water from the sea to many British inland towns.

After admitting these natural advantages for what they are worth, the Royal Commission went on to point out that the most significant advantage enjoyed by Continental waterways must be sought elsewhere, namely, in the different system of administration already alluded to, and the completely different attitude of the State and of public opinion to the whole transport question.

According to the view which has long prevailed on the Continent, the provision of cheap and efficient transport, whether by road, rail or water, is a matter of national importance on which not only the development of individual industries but the general progress and prosperity of the country depend. In Germany and Belgium all three systems of transport are controlled by the central government for the benefit of the whole community. Tolls on canals and rivers are low or non-existent, and the greater part of their costs is met out of national revenue. In France the State has not, until recently, owned the majority of the railways, but they were constructed under State guarantees, and their policies have always been subjected to very close regulation. The canals and rivers on the other hand, like the roads, have always been the property of the State and are toll-free.

In spite of the fact that the railways are fairly strictly controlled in all these countries, they have, for instance in France, cut their rates to an excessively low level during the past year or two in order to keep up their traffic, not only against road competition but against what up till recently has been considered canal traffic, with disastrous results to all three forms of transport. The canal carriers are complaining that they have lost since last year 15 per cent. of their traffic to the railways, and though the railways have again had to raise their rates between 10 and 15 per cent., this has not brought relief to the water carriers.

New Developments Abroad

While many of the circumstances are different, there remains the fact that the countries of Northern Europe are still spending large sums in developing the waterways. Belgium is constructing the Albert Canal from Liège to Antwerp; Holland has recently built the Juliana Canal along the Maas, and also constructed the Twente Canal from Zutphen to Enschede. In Germany the new canal to Berlin has recently been opened. The Rhine-Danube Canal was re-dredged throughout a few years ago, and the Mittel-land Canal, providing a waterway for vessels of several thousand tons between Ruhrort on the Rhine and the Elbe near Hamburg, is rapidly nearing completion. Russia has just completed the large canal from the Volga to Moscow and the Archangel Canal, and is contemplating joining the Volga to the Don. All these developments and consequent large capital expenditure are made with the object of developing trade and opening up the interior of the countries to the sea. Various treaties since the war have recognised the importance of navigable rivers, especially for countries cut off from the sea, such as Switzerland, Czecho-Slovakia and Hungary, and consequently have declared the rivers Rhine, Elbe and Danube international waterways.

The Twente Canal

Perhaps one of the most striking examples on the Continent is the making of the Twente Canal in Holland, which was opened last year. This canal was constructed by the co-operation of the Province of Over-Ijssel and the four largest Chambers of Commerce, who contributed 5,000,000 florins towards the 27,000,000 florins required to complete the canal. The canal is 75 miles (120 kilometres) long, and can take barges of 1,350 tons dead weight, connecting the industrial area round Enschede with the Upper Rhine and the Ijssel. It can easily be enlarged to take boats of 2,000 tons dead weight at a later date. It is calculated that a reduction in transport costs based on present rates would have been in the neighbourhood of 36 per cent. if the canal had been opened in 1925, and it is estimated that the reduction will reach over 40 per cent. in 1945. The canal was opened in August, 1936, and the Hengelo Chamber of Commerce reported that the total reduction in unemployment from the beginning of August until the end of October, 1936, was 11 per cent. in the textile industry and 11 per cent. in the metal industries, but there was an increase of 11 per cent. in unemployment in the building trade due to the completion of the canal. Similar figures showing the saving in freight charges are, I believe, obtainable for other canals which have recently been opened.

Inland Navigation in Russia

Another example of the development of waterways is what is being done in Russia. The three main new developments are the Baltic-White Sea Canal, the Moscow-Volga Canal, and the Dnieper Navigation. The Baltic-White Sea Canal is a sea level waterway connecting the White Sea at Soroka with Leningrad on the Baltic, the northern length from Lake Onega to Soroka (166 miles) having been constructed in 21 months. The saving in distance from Leningrad to the White Sea is 2,200 miles, gaining 12 days *en route*. The Moscow-Volga Canal was opened last May, and connects Moscow with the Volga and so with the five seas, the Baltic, White, Caspian and, by a further canal to be made between the Volga and the Don, with Azov and the Black Sea.

In addition to this new construction, the Russians are overhauling the whole of their river transport equipment. Already about half of the 101,000 kilometres of river routes are equipped for night traffic. Old wharves have been reconstructed and re-equipped; repair shops have been increased in number and the old ones re-conditioned; loading and unloading have very largely been mechanised, and new storehouses, refrigerators and elevators have been built. Finally, several new shipbuilding yards have been constructed, and during the past eight years the number of steamers and other vessels on inland routes has been doubled. There has also been a great improvement in the quality of the new vessels, which are of greater capacity and can develop greater speed than their predecessors. The effect of these improvements can be seen in the fact that the quantity of freight carried has increased from 18,300,000 tons in 1928 to 87,100,000 tons in 1937, whilst the number of passengers carried has risen from 17,800,000 in 1928 to approximately 50,000,000 in 1937. According to the Planning

Timber Barges on River Severn.

The Economic Future of Canals—continued

Department, these figures will be approximately doubled by 1942, and there is every reason to anticipate that the plan will be fulfilled if not exceeded.

The Position in Great Britain

With this brief summary of recent Continental developments in mind, we may now turn to consider the position in this country. As is well known, the pre-war Royal Commission recommended that the main line waterways forming "The Cross" should be brought up to the 100-ton standard throughout, and even considered the possibility of a 300-ton standard, though they rejected this latter alternative on the ground of expense. They also recommended that financial assistance should be given by the State towards the regeneration step by step of the English waterways. They pointed out that the waterways had suffered from long neglect and errors in legislation, and that it was consequently unreasonable to expect them to pay in full for the cost of their improvement, especially since a vital part of the Commission's proposals was that tolls should be kept low, if not abolished entirely, in accordance with Continental practice.

Electric Tractor on Canal near Lille, France.

At the time of the 1906 Commission's report the only effective competitors with water transport were the railways. Since then the situation has been altered by the advent of the commercial motor vehicle on the roads, but far from invalidating the Commission's proposals for Government assistance this factor only strengthens them, since even in England the roads, unlike the railways, are owned and administered by the State (whether through the central government or the local authorities is immaterial). The State has now been obliged to regulate the conditions of road transport and to modify its attitude to the railways by giving them greater freedom of action and material assistance, so that the time has come when canals and waterways should also receive consideration.

Whilst the case for some kind of Government assistance is even stronger than it was before the war, the changes which have taken place in the meantime make it necessary to re-examine the position in the light of present conditions and to consider in what form that assistance could now best be given. It is as important as ever to bring our principal waterways up to a modern standard of efficiency, and to equip them with adequate facilities for handling traffic, and it also remains essential that tolls should be reduced and their system of collection overhauled. Whether this can best be done by the formation of a Waterways Board on the lines suggested by the Royal Commission, or by the Regional Trusts which were proposed by the Chamberlain Committee in 1921, or whether some other type of administration is likely to be more effective, is a matter which I propose to discuss shortly. Before doing so, however, I should like to recall certain factors which have come into increasing prominence during the past few years.

The Danger of Monopoly

Following on the amalgamation of the railways into four main companies and the consequent reduction of their former competition with one another, we are now witnessing the gradual concentration of road hauliers into fewer hands and the creation of almost monopolistic values for holders of *A* and *B* licences. At the same time, the railways now hold large financial interests in road undertakings, so that the manufacturer or trader finds himself being hemmed in on all sides, and his sole remedy is to own his own fleet of road vehicles with *C* licences, or else to turn to the only alternative method of transport, namely, the waterways. Even here he finds important links owned by the railways, who have it in their power to be obstructive if they wish by reason of their control over tolls and by making awkward regulations and bye-laws. The trader is therefore taking careful note of the position of waterways so that he may see if it is possible to have another independent method of transport available for his use. Even if on narrowly financial grounds it may be difficult to prove the economy of water transport, yet on general grounds of policy there are vitally important reasons for their retention. It is well known that when railway routes are paralleled by efficient water routes the rates are generally lower than when such conditions do not exist.

Where modern operating methods have been introduced on waterways considerable economies have resulted. The introduction of the Diesel engine has made a revolution in water transport. The engine, requiring no engineer and controlled directly from the bridge, gives the maximum of mobility at a minimum of cost. Even on narrow boats, where there is no reduction of personnel, the ability of the boats to keep going and to move under their own power, enables them to navigate rivers and pass through tunnels without waiting for tugs. The increased speed and elimination of waiting time has resulted in a reduction of over 10 per cent. in the running costs on one route, even after making liberal allowance for overheads and wear and tear.

There are also other factors which are not strictly economic, such as the question of alternative routes in case of a blockage on the railways, or the congestion of certain road routes. Then the question of safety comes in. Last year there were 4,038 accidents and 329 persons killed on the roads by motor lorries, while in the Transport Advisory Council's recent report the railway companies (referring to canal transport) have pointed out that—"There is no statutory provision for enquiries into accidents, as presumably there is no need for them."

There is another argument which cannot be overlooked. Each form of transport has some special facility to offer peculiar to itself. Waterways undoubtedly can give a cheap service—especially from alongside ship—which is invaluable, and this, coupled with the direct service of each boat to its destination, often enables water transport to compete with rail and road on exceptionally favourable terms.

One very interesting experiment in the use and convenience of waterways was made at Nottingham some years ago. Messrs. Cammell, Laird and Co. built 160 broad-gauge railway coaches, each measuring 68-ft. long and 12-ft. wide, for India and, by constructing a special barge, were able to ship them down the Trent to alongside ship at Hull much more cheaply than they could have sent them by road or rail. I feel sure that for the transport of large pieces of machinery the waterways offer a convenient alternative to rail, on which it is frequently necessary to make expensive temporary alterations to the track and to arrange for transit to be effected on Sundays, causing much dislocation of ordinary working. They would also free the roads from the large loads which occasionally have to use them and which are not only liable to damage the road itself, but also obstruct ordinary traffic very seriously. For instance, it would be quite practicable to ship machines weighing 150 tons and measuring 14-ft. diameter by 70-ft. long from Stourport down the Severn to alongside ship in existing barges, if the necessary loading plant were installed.

Traffic Statistics

Although it may not be possible to establish the full economic advantage of canals and inland waterways by actual comparative costs, this can, I think, be established indirectly by studying the trend of traffic at home as well as the developments on the Continent, which I have already briefly outlined.

The Economic Future of Canals—continued

Under the Railway and Canal Traffic Act of 1888, the Board of Trade was given statutory power to demand from canal undertakings annual returns as to capital, traffic, expenditure and revenue. Unfortunately, it was not considered necessary to ask for these returns more often than once every ten years, so that statistics are most incomplete. The first return was made in 1888, and subsequent returns cover the years 1898 and 1905. Since the war the Ministry of Transport has published regular figures relating to canal traffic in the annual railway returns. From the same source can also be obtained full financial particulars relating to railway-owned canals. In the case of the independent waterways the published accounts and balance sheets are sometimes available, but full and detailed information with regard to their revenue and operating expenses is sadly lacking.

Standard Cargo Boat on Weaver Navigation.

The general effect of the traffic statistics is as follows:

Traffic originating on the independent canals rose from 9,700,000 tons in 1898 to 10,800,000 tons in 1905, an increase of 11.3 per cent. On the canals owned and controlled by the railways, on the other hand, the change was from 12,100,000 tons to 10,600,000 tons, a drop of about 12.1 per cent. Even more remarkable is the relative fall between 1905 and 1927. Tonnage originating on the independent canals fell from 10,800,000 to 9,350,000 tons, or 13.4 per cent., whilst that on the railway-owned and controlled dropped from 10,600,000 to 6,065,000 tons, that is to say, by as much as 42.7 per cent. During the past ten years the discrepancy has continued, though it has been rather less marked; the fall in the volume of traffic originating on the independent canals between 1927 and 1936 being 18 per cent., and on the railway-owned and controlled 22 per cent. It is obvious that the owner of the canal has a great power of control over the traffic which originates on his waterway. This great discrepancy between the railway-controlled and independent canals is significant and seems in itself to be a condemnation of the policy of allowing railways to own or control waterways.

Whilst most impartial observers would, I think, assent to the proposition that railway ownership is fatal to the health of any canal undertaking, there are many who maintain that even the independent waterways are undergoing a lingering death which is slower, but no less certain, than that of those in the hands of the railway companies. It must be admitted that at first sight the facts that I have quoted tell in favour of this view, but, as is so often the case, aggregate figures taken over wide intervals are misleading. This is particularly true of the last ten years during which the net decline between 1927 and 1936 masks a fairly rapid fall between 1927 and 1932, and a modest but gratifying recovery on the independent canals since that date. There is, moreover, an important group of waterways on which traffic has been increasing, not merely during the past few years of trade recovery, but throughout the post-war years, even though in most cases it is still below pre-war levels. The most important of these waterways are the Gloucester and Sharpness Ship Canal, the River Severn, the Sheffield and South Yorkshire Canal, and the River Trent, the traffic on which has grown in the manner shown by the following table:—

	1928 Tons	1936 Tons
Gloucester and Sharpness	257,758	460,318
Severn Commission	120,688	283,977
Sheffield and S. Yorks	451,235	771,264
Trent Navigation	355,856	581,097

This is an increase of 77 per cent. in 8 years for the group.

On several others, including the Aire and Calder, the Bridgewater, the Calder and Hebble, the Leeds and Liverpool, the Oxford, and the Worcester and Birmingham Canals, traffic, while not yet actually showing an increase since 1928, has returned to approximately the level of that year and, on the face of the figures alone, may reasonably be expected to continue to grow slowly in the future.

In any discussion of the future of inland navigation, it is important to concentrate attention on these waterways which, even under present conditions, are prospering. Three of the four waterways shown in the table are navigable rivers, whilst the fourth, the Sheffield and South Yorkshire Canal, is of sufficient dimensions throughout to take Yorkshire keels with a load of 80 to 100 tons. Of the other canals mentioned, only two—the Oxford and the Worcester and Birmingham—are narrow-boat canals, which possibly suggests that for this type of waterway there is not much future except under special circumstances.

(To be continued).

Port Labour in Aberdeen and Glasgow

*Excerpt Summary of Report by Board of Inquiry**

In the port transport industry the volume of work at a dock—being dependent upon a variety of factors, e.g., the action of tides, the uncertain and irregular arrival of vessels, the necessity for a prompt turn-round of vessels, which are in the main outside the control of those responsible for carrying on the industry—is subject to rapid fluctuations. In consequence of these fluctuations there tends to gather around the dock at any port a body of men who are not regular dock workers but who from time to time obtain employment at the dock and are constantly passing into and out of employment at the dock.

It has long been recognised that this influx of workers seeking employment at the docks aggravates the difficulties due to the casual nature of employment in the industry and injuriously affects the employment position of the regular dock workers. Experience has shown that the most effective method of mitigating and counteracting the evils arising from excessive numbers of men seeking employment in dock work is to regulate the supply of labour by granting a perference in port employment to selected workers, whose number is determined on the basis of the local labour requirements. The fundamental aim of registration schemes is to establish such a system of preference and to provide methods of concerted efforts based upon the principle of preference. In Glasgow and in Aberdeen such a system of preference has for many years been firmly established.

The evidence led at this Inquiry shows grave defects in the operation of the existing preference systems at Glasgow and at Aberdeen—defects arising mainly from the methods in use for the engagement of labour. The evidence also shows the prevalence at Glasgow of widespread abuses of the Unemployment Fund—abuses attributable in large measure to the fact that the preference system at that port is not working effectively.

The question at issue at Glasgow and at Aberdeen is whether greater regularity of employment in the industry can be more effectively attained by establishing at these ports registration schemes embodying certain features which are now represented to us as essential in such schemes or by taking steps to render more efficient the existing systems of preference and labour organisation and to improve other arrangements now obtaining at these ports.

We have given very careful consideration to the representations made on behalf of the Standing Advisory Committee at the Inquiry. But we have to deal with the facts of the situation in Glasgow and in Aberdeen. We cannot ignore these facts or pretend that the facts are not what they are.

As the law now stands, any organised system for the engagement and distribution of labour at a port is dependent upon the voluntary agreement and co-operation of employers and employed. The evidence makes it plain that the dock workers at Glasgow and Aberdeen will not consent to adopt, or to co-operate in, a registration scheme embodying all the features advocated by the Standing Advisory Committee and involving

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Port Labour in Aberdeen and Glasgow—continued

drastic alterations in the functions now exercised by the Trade Unions under the preference systems in operation at these ports, or any scheme which includes, as part of its machinery, the use of employment record books.

We appreciate that at many ports—in particular, at ports where no preference system had previously been established—registration schemes have accomplished much to promote greater regularity of employment. We also appreciate that for certain purposes, e.g., for the purpose of obtaining statistical information on a comparable basis with regard to the employment position of the workers at the ports of this country, it is desirable that the procedure set up under organised schemes should be of a more or less uniform type.

We, however, are of opinion that where, as in Glasgow and in Aberdeen, the fundamental principle of preference for selected workers is firmly established at a port, the machinery and procedure for the application of that principle should be adapted to the local circumstances at the port; and that it is more important that it should be so adapted than that it should conform to a "model." We consider that an insistence on rigid uniformity and on the adoption of particular machinery, e.g., employment record books, as essential to any scheme for promoting greater regularity of employment for dock workers which is to receive Departmental assistance is a policy which, if applied in Glasgow or in Aberdeen, would frustrate any effort to improve by voluntary action the systems of organisation now existing at these ports. We do not under-estimate the importance of "machinery" in the administration of a scheme; but we recognise that the maintenance of a co-operative spirit on the part of all concerned is essential to the efficiency of any scheme.

The evidence led at this Inquiry has shown very fully and very plainly the difficulties with which employers in the port transport industry are confronted. We appreciate that the employers, and the shipping industry as a whole, have a vital interest in ensuring that the system of labour-organisation and labour-engagement at the docks is such as will provide a sufficient supply of efficient workmen not only to meet normal requirements but also to meet exceptional pressure which may arise from time to time.

It is clear to us that, notwithstanding the strong and marked divergence in the views held on the one side and on the other with respect to certain matters, the employers and the workmen, both in Glasgow and in Aberdeen, have in the past made co-operative efforts towards achieving the smooth running of the work of the ports. We feel strongly that the co-operation which has existed should continue and, if possible, be increased; that any steps or measures now to be taken should be such as will encourage and assist co-operation; and that insistence by the one side or by the other on steps or measures which would prevent or impede such co-operation may have results injurious to all concerned. We are convinced that schemes on the lines set out in the next paragraph of this Report represent what, at the present time and under existing conditions, can be accomplished by voluntary agreement towards promoting greater regularity of employment in the industry at Glasgow and at Aberdeen; and that schemes on these lines, if agreed to by the parties, would prove in practice advantageous to the industry at these ports and go far to bring to an end abuses of the Unemployment Fund at these ports.

Conclusions

We, on a consideration of the whole evidence, have reached the conclusions (1) that registration schemes, or other schemes, by whatever name they be called, under which preference in port employment is granted to selected workers whose number is determined on the basis of the local labour requirements and under which proper methods are taken to regulate and co-ordinate the engagement of labour, have proved of great advantage in promoting regularity of employment; (2) that, under existing circumstances, the workmen at the ports of Glasgow and Aberdeen are not prepared to assent to the adoption of any registration scheme which provides that the register of recognised port workers is to be compiled by, and under the sole control of, a joint committee representing the port employers and the dock workers and that the token of registration is to be an employment record book issued by that joint committee to each recognised port worker and withdrawable at any time by that joint committee; and (3) that the defects existing in the operation of the preference systems now obtaining in Glasgow and in Aberdeen—systems which have been long established at these ports and under which preference of employment is granted to members of the Trade Unions representing the workmen at these ports respectively—have arisen mainly from the methods in use for the engagement of labour. We consider that greater regularity of employment at the ports of Glasgow and Aberdeen would be attained by the organisations representing the employers and the organisations representing the workmen at these ports respectively agreeing to schemes on the following lines:—

(1) The Associations representing the employers and the Trade Unions representing the workmen at Glasgow and Aberdeen respectively to establish at each of these ports a joint committee for the purpose of promoting the more convenient engagement and the more regular employment of workmen at the port. The committee to consist of ..... representatives appointed by the Employers' Association and ..... representatives appointed by the Union. The committee to be formed on the basis of balanced panels of employers' and workmen's representatives.

(2) The committee to establish calling-on stances, appropriately distributed throughout the docks, where workmen would assemble for engagement. All workmen seeking engagement at a particular call-time—including workmen who had been previously notified that they would be engaged but are not under a binding agreement—to assemble for engagement at a calling-on stance. The committee may sanction arrangements under which workmen who are already under a binding engagement are not required to attend a calling-on stance during the subsistence of that binding engagement. The calling-on stances to be as few in number as is practicable, having regard to the lay-out of the docks and the facilities for men reaching the place of work after engagement. The committee to arrange that all the calling-on stances be in telephonic communication and, as far as practicable, to adopt methods of co-ordination between the calling-on stances with a view to facilitating the effective distribution of the workmen to meet the day-to-day requirements at various points in the port.

(3) The Union to provide the committee with a list of the members of the Union as at the date of the establishment of the committee. That list, which would include weekly-paid men who are members of the Union, to be accepted by the committee as constituting for one year (or such longer period as may be thought desirable to afford experience as to the adequacy of the list to meet the normal requirements of the port) the list or register of recognised preference port workers. After the expiry of a year (or longer period) the committee to consider from time to time whether or not changes should be made in the number of men on the list or register. A decision of the committee that a sepecified number is to be added to the list shall determine the number of men to be added, and thereupon the Union will determine the individual men who are so to be added to the list and admitted to the membership of the Union. Membership of the Union to be a condition of enrolment on the list. The Union to give due consideration to representations made by the committee as to the suitability of men enrolled on the list or applying for enrolment on the list.

(4) The committee to co-operate with the employers, the Union and the Ministry of Labour in collecting information as to the extent of the employment obtained by individual men enrolled on the list or register. The Union and the committee shall take into consideration the information so collected.

(5) Employers to undertake not to engage any man unless he hold a current Union badge identifying him as being enrolled on the list or register, except that if at any calling-on stance there be a shortage of suitable enrolled men an employer may engage non-enrolled men on a daily basis. Employers to send in to the committee as full particulars as possible of all non-enrolled men employed by them on any day.

(6) There shall be co-ordination and co-operation as far as possible between the committee and the Ministry of Labour officials in the matter of unemployment insurance.

(7) Questions of discipline to continue to be dealt with on the same lines as hitherto.

(8) Any scheme now to be established shall be regarded as experimental and subject to alteration in the light of observation of its operation.

Recommendation

By the Unemployment Insurance Act, 1935, Section 100 (1), the Minister of Labour is empowered, under certain conditions, to assist schemes for promoting greater regularity of employment in any industry. In the event of schemes, on the lines of our proposals, for promoting greater regularity of employment in the port transport industry at Glasgow and at Aberdeen being agreed on by the organisations representing employers and the organisations representing workpeople in that industry at these ports, we recommend that, on joint application by the organisations of employers and workpeople at these ports respectively, these schemes be approved by the Minister and that the Minister assist the administration of the schemes by attaching officers of the Ministry of Labour to help in the administration thereof and by such other means as he thinks fit.

The Report is signed by J. M. Irvine, Esq., K.C., LL.D. (Chairman), Sir James Leishman, T. Murray Taylor, Esq., M.A., LL.B., and W. Yeardye, Esq. (Secretary).

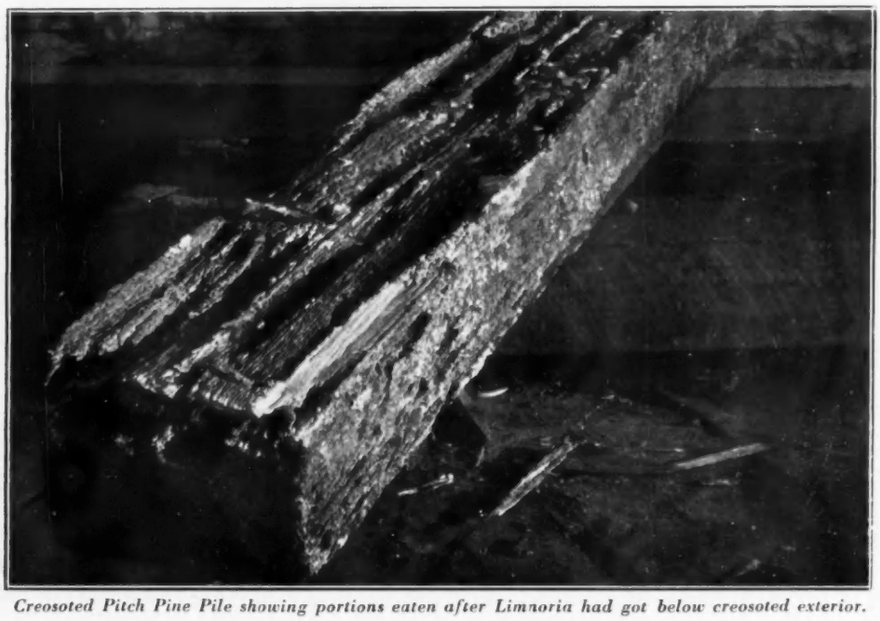
Greenheart

Some Notes on its Deterioration, with Special Reference to the Attack of "Limnoria" and "Chelura" at Blyth Harbour, 1932

Investigations conducted by C. E. BALDWIN

GREENHEART (Nectandra Rodiœi) is a close straight-grained timber exported from British Guiana. In colour it is lustrous, light to dark olive and occasionally, almost black. Resinous in-growths (Tyloses) into the pores of the wood tend to make it darker and as the tyloses develop with the growth of the tree, the maturity of the timber may to some extent be gauged by the colour and in general, the darker coloured timber is the more durable.

In addition, the younger trees have a very great proportion of sap wood which is greatly inferior in resisting deterioration in sea-water. Seasoned greenheart should weigh about 70 lbs. to the cubic foot (specific gravity 1.06 to 1.23).



Creosoted Pitch Pine Pile showing portions eaten after Limnoria had got below creosoted exterior.

Several timbers have been sold as substitutes for genuine greenheart, and some of them come from British Guiana Greenheart Forests. These forests carry a considerable quantity (70 per cent.) of timbers, principally Morabukea and Mora, which exhibit many of the characteristics of greenheart but which are unsuitable for maritime work. Mora (Dimorphandra Mora), for example, is a tough, hard, close and straight-grained timber of a reddish green colour, obtainable from British Guiana in logs up to 100-ft. in length. Its weight is, however, generally about 5 lbs. per cubic foot lighter than greenheart, and "it does not resist the Toredo and other marine borers." (Haman "Timbers of Tropical America").

Greenheart owes its power of resistance to worm infection to its texture, to the presence of an alkaloid (soluble in alcohol) known as Bebeerine and to the resinous Tyloses. It is considered as by far the best timber, as regards the power of resisting the attack of marine borers, and the following cases are generally cited in support of this belief:—

(1) Greenheart lock gates at Liverpool were found (1918) to be in first-class condition with no signs of decay, after 61 years' immersion. (T. M. Newell, M.Inst.C.E.).

(2) Greenheart which had been in position for over 20 years at the Tyne Piers had not been attacked. (R. F. Hindmarch, M.Inst.C.E.).

On the other hand:—

(1) At Algoa Bay, Cape Colony . . . . "the piles, fenders, and walings of the so-called Greenheart Timber, which had been in use only for 8 years . . . . at every scarf, and where the vertical fenders were cleated to the walings, the Limnoria had completely destroyed the timber under the surface." (Min. Proc. Inst. C.E., Vol. CXXX, p. 265).

(2) A pile at Holyhead was eaten to a depth of 2 inches all round in 20 years by Limnoria. (E. F. C. Trench, M.Inst.C.E.).

(3) The piles in the New West Pier at Blyth were found (1928) to be extensively attacked by Limnoria after being from 6 to 14 years in use. The attack was generally, though not exclusively, in the cracks caused by the pile-driving ram.

(4) The piles at the South Gare Breakwater in the River Estuary (Tees Conservancy) were reduced from scantlings of 12 to 14 inches square to approximately 4 inches square in 20 years by Limnoria and Chelura. (Engineer Tees Conservancy Commission).

The "Limnoria Lignorum" (or Terebrans) is a small Crustacean of the order of Isopoda, in appearance like a miniature wood-louse (which belong to the same family) and is generally one-eighth to one-sixth of an inch in length. It attacks mainly between half-tide and ground level. It appears in great numbers, and as many as 54,000 perforations have been counted in a square foot of timber. It bores short tunnels about one-twentieth of an inch in diameter and up to 2 inches in length, obliquely to the surface, so that the actual penetration of the timber is usually not more than half an inch from the surface. The difficulty of obtaining the necessary currents of water for respiration prevent the Limnoria from penetrating beyond half an inch or so from the surface, but successive honey-combed layers are washed away by sea-action and pitch-pine timbers are found to be continually reduced by about half an inch per annum on all exposed sides.

It is generally believed that the Limnoria is unable to bear too great a reduction in the salinity or too great a pollution of water, e.g., on the Tyne the Limnoria is found below the Northumberland and Tyne Dock entrances, and is most active near the mouth of the river but above Tyne Dock, timber, even if not preserved, is not attacked. (R. F. Hindmarch, M.Inst.C.E.).

The experience is, however, not confirmed at Blyth where greenheart piles exposed for nine years in the Tidal Basin were vigorously attacked although the water is not pure and is considerably diluted by fresh water coming down the river.

The Engineer at H.M. Dockyard, Devonport, states definitely that neither the variation in the constitution of the water nor sewage discharge have any effect upon the activities of the Limnoria at that port.

The "Chelura terebrans" is a small Crustacean of the order of Amphipoda, in appearance resembling a shrimp, measuring one-eighth to one-quarter of an inch in length. It is easily distinguishable from the Limnoria by the pair of large tail-appendages at the hinder end of the body. It bores up to about one-tenth of an inch in diameter obliquely to the surface.

While Limnoria are often found alone, no case is yet known of the Chelura working independently of the Limnoria.

The ravages of the Limnoria and the Chelura were well known at Blyth for many years—particularly in the case of pitch pine, which had been (1) imperfectly creosoted, or (2) split or sawn after creosoting, leaving a raw surface for the entry of the Limnoria. As an example, work has been carried on almost continuously since 1919 in protecting the piles of the North Side Staiths (Creosoted Pitch Pine) with a jacket of cement grout.

It was generally understood, however, that the hard woods, e.g., blue gum and greenheart, were immune from attack, and greenheart had been definitely recommended for the construction of the West Pier as a timber "which the sea-worm of this coast does not attack" (8th July, 1913).

The behaviour of blue gum, however, in the West Pier focussed attention on this point and raised grave doubts about greenheart itself. The construction of the West Pier was rather protracted, owing to war conditions, and blue gum piles (14-in by 14-in.), driven in 1916, were found to be practically destroyed before the pier was completed, with the result that

Greenheart—continued

additional greenheart piles had to be driven to preserve the structure.

By 1928 it was evident that the greenheart piles had themselves been attacked. Approximately one-half of the piles was found to have been attacked in varying degrees not proportional to the period of exposure. Indeed, the pile showing the most deterioration was at the extreme seaward end, and had only been exposed for six years. This inequality of attack under equal conditions led to the conclusion that the greenheart supplied was not of a uniform quality.

A systematic examination of all the greenheart throughout the harbour was then made and the results summarised as follows:—

Report on the Condition of Greenheart at Blyth, April, 1928

Position.	Date piles driven.	Name of Animals identified.	Condition.
No. 35 Jetty at top end of Harbour	1918	Limnoria	16 Piles withdrawn for repairs (Mechanical damage) are all attacked from L.W. to ground level. The reduction in scantlings is not yet great.
South Side Staiths ... (Middle Harbour)	1882	Limnoria	Majority of piles practically unmarked. About 1 in 20 is attacked and reduced on surface by half an inch. The Pitch Pine on the Staiths has been eaten through. (This has since been renewed).
North Quay ... ... (South Harbour)	1910	Limnoria Chelura	About 1 in 10 of piles attacked and 1/10th of lower crossties (Creosoted Pitch Pine) which are reduced to about ⅝". (These have since been renewed.
Ice Factory Quay ... (South Harbour)	1911	Limnoria	Practically immune, sapwood slightly affected. Pitch Pine butt straps badly eaten. (These have since been renewed.)
South Quay ... ... (South Harbour)	1910	Limnoria	About 1 in 5 of the piles are attacked.
West Pier ... ... (Harbour Entrance)	1914 to 1921	Limnoria Idotea Chelura	The borers are found from seaward end to 700 feet landwards (length of pier 1440 ft.). Majority of piles are more or less attacked chiefly in the cracks. The worst surface attack is on pile at entrance end. (Driven 1921).
New West Staiths ... (at top end of Harbour)	1914/15	—	No attack found above L.W. Level.

These facts were reported by me to the Commissioners; they therefore instructed me to pursue every possible line of investigation.

While it is to be regretted that much of the evidence collected is of a negative character, and in some cases is even contradictory, a great deal of useful information has been obtained, as will appear in the summary of the investigation which follows:—

Summary of Investigation

(1) Correspondence with the Government Trade Commissioner for British Guiana in London elicited the information that it is now possible to have all logs passed and stamped (B.G.G.) by the Forestry Department in British Guiana. (Note: When Mr. Hohenkirke, Deputy Conservator and Superintendent of Forestry Surveys of British Guiana, visited Blyth on June 11th, 1928, he was handed a sample of reputed greenheart (Log No. K. 61—see also Analysts Report). He at once expressed the opinion that it was not greenheart but White Waibaima. This indicates the difficulty in identifying genuine greenheart and the necessity of specifying all logs to carry the Government Stamp).

(2) Samples from logs received about 10 and 20 years ago respectively, were submitted to the Public Analysts Laboratory, Newcastle-upon-Tyne, with the following results (February, 1928):—

	K. 61. 10 years old.	No Number. 20 years old.
Average Specific Gravity	0.982	1.078
Resinous content	4.42%	3.26%

It was not found possible to determine the relative quantities of alkaloid in the samples, though its actual presence was confirmed. (Note: Specific gravity of greenheart should be 1.06 to 1.23 (Inst.C.E.). The specific gravity of K. 61 is outside these limits, but corresponds to the specific gravity of White Waibaima, i.e., 0.999).

(3) Specimens taken from the greenheart of the West Pier were submitted to Professor Meek of the Department of Marine Biology, Armstrong College, and were identified as: Limnoria Lignorum; Idotea Pelagica.

The latter is not a wood-boring animal.

(4) A sample of greenheart was steeped in cold creosote oil, but after one month's immersion no penetration of the oil below the surface could be detected.

(5) Two samples of greenheart, 10 and 20 years old, were carefully weighed and sent to creosoting works to be included in the tanking of pitch pine logs under pressure. In neither case was any considerable quantity of oil injected.

(6) The heads of some of the sheet piles (below half-tide level) at the West Pier were drawn together with wrought iron hoops and the centre grouted up with cement. This operation presented no difficulties, and appears to afford complete protection to the heads of the piles. Piles so treated have not deteriorated further at the heads to date (1932).

Method of protecting 688 Piles with Cement where it is not possible to drive new ones owing to the Staiths Superstructure.

(7) The heads of a row of sheet piles in the West Pier were completely encased in cement, reinforced with steel rods. This operation presented no difficulties, and affords good protection in cases where the piles are too far gone to use the cheaper method of "hooping." It is liable to be cracked by pressure on the pier but, even so, would provide considerable protection as the Limnoria would be unable to obtain through the cracks the currents of water necessary for its respiration. (Note: While this method is completely successful for the heads of the piles, neither it nor the previous method solves the difficulty of protecting the lower portion of the piles. Sixteen rows have been covered to date (February, 1932) and all are in good condition).

(8) A sample of Mora timber was obtained from the Imperial Museum, South Kensington. This was easily distinguishable from greenheart by its reddish colour.

(9) The piles of the Middle Jetty were given two coats of "Bitumel" (a bituminous black paint) before driving (1928-29). The difficulty in this method is to prevent the paint from being scraped off during construction. Sufficient time has not yet elapsed to give a definite report on its qualities. There are, however, no signs of attack to date (1932).

(10) On the advice of Professor Meek (Armstrong College) experiments were made in the use of a flat steam jet. (August, 1928). He had found that water raised to a temperature of between 90° and 120° was fatal to the Limnoria. Accordingly, a flat punt was equipped with a steam boiler and flexible hose and operated against some of the more seriously attacked piles. This method has, however, several definite drawbacks. It is slow, costly, and attended with great difficulty, especially in the case of piles in the centre of a quay or jetty, and in all cases below low water.

Greenheart—continued

Moreover, an experiment with a jet on land upon a worm-eaten pile freshly drawn from the water proved that, while the Limnoria were visibly affected near the surface, those embedded in burrows more than one-eighth inch deep were quite immune from the effect of the steam. Experiments were also made in charring the affected timbers with blow-lamps with only a very limited success. This method has, in addition to the defects of the steaming system, the danger of starting fires in very inflammable structures.

(11) A station was established (1928) at the Import Jetty, South Harbour, for the simultaneous exposure of selected timber samples, treated and untreated. These are inspected periodically, and a careful record is kept.

The attack on the untreated white wood and blue gum samples began within six months, and the latest examination (February, 1932) reveals the following results:—

Sample.	Timber.	Treatment	Condition.
1.	White Wood	None	Eaten through
2.	do	Copper Sulphate / Potassium Ferrocynide	do
3.	do	Camrex Paint ...	do
4.	Greenheart	Charred	Not attacked
5.	do	Bitnamel	do
6.	do	None	do
7.	Pitch Pine	None	Attacked by Limnoria and Chelura
8.	do	Charred	Attack not so developed
9.	do	Bitnamel	as No 7
10.	Spruce	Creosoted	Slight attack
11.	do	Bitnamel	Not attacked
12.	do	None	Heavy attack
13.	Blue Gum	Charred	Attacked at bottom
14.	do	Bitnamel	Slight attack
15.	do	Plain	Heavily attacked

These results would appear to confirm (1) the great superiority of greenheart over other timbers; (2) the unsuitability of blue gum; (3) the manufacturer's claim that "Bitnamel" is capable of resisting attack by Limnoria; (4) that neither copper sulphate nor potassium ferrocynide (Sample No. 2) are toxic to the Limnoria under natural conditions (as suggested by the staff of Dove Marine Laboratory).

General Conclusions

From the experience so far gained, the following general conclusions may be summarised:—

(1) Greenheart, while not immune, is the best known timber for resisting the attack of marine borers.

(2) It is inadvisable in specification to limit the maximum scantlings. This produces a tendency to select the longest logs from immature trees quickly grown in unsuitable ground. The timber from such trees carries a much greater proportion of sap wood, is of a lower specific gravity and is less resistant to deterioration in sea-water.

(3) The contention, so often repeated, that "the well being of the crustacean is dependent upon a supply of pure sea-water" is not confirmed at Blyth. Pronounced attacks, as has been noted, are found: (a) in clear sea-water at the West Pier; (b) in water contaminated by sewage at the South Side Staiths and West Quay; and (c) in sea-water containing a fair proportion of fresh water at No. 35 Jetty in the Tidal Basin.

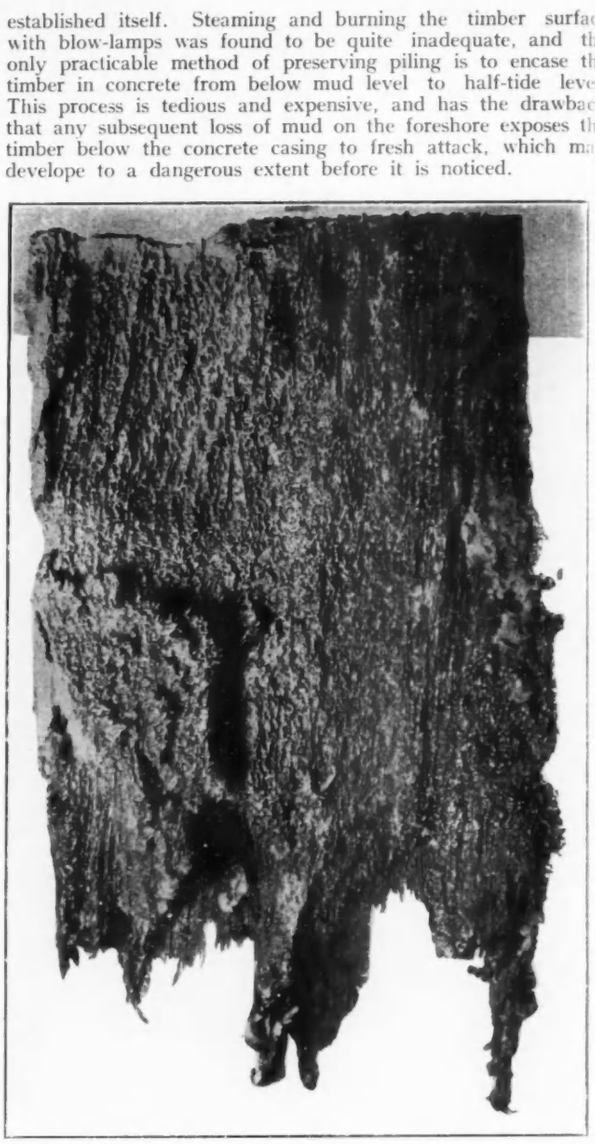
(4) The impregnation of greenheart with chemical solutions is not practical and, in any case, they have proved quite unsuccesful in the case of other timbers, owing probably to the "leaching out" of the solution on immersion. Creosote, which is known to be a protection, cannot be impregnated into greenheart.

(5) The best protection of a temporary nature appears to be afforded by a careful application of a bitumastic paint which resists the action of sea-water, dries with a good hard coat and is waterproof. A perfectly smooth surface appears to afford protection by not giving the borers a foothold to start operations. Obviously, such a precaution can only be taken under very limited conditions.

In conclusion, the Limnoria and Chelura exist throughout the harbour from the entrance channel to the upper reaches of the river, a distance of nearly two miles. Timber work in the Tidal Basin at the farthest point from the sea where the salinity of the water must be low and where considerable sewage contamination exists is attacked in only slightly lesser degree than is timber at the pier ends in practically pure sea-water. The protection afforded by sewage is of a contradictory nature—at the shipyard graving dock entrances where a large sewer discharges directly at the wharf, there is almost complete immunity from attack on pitch pine timber, and the same condition applies at No. 23 Jetty in the Tidal Basin some 30 yards from the outfall of a small sewer, whereas in the South Harbour, pitch pine timber is heavily attacked, although the discharge from a medium-size sewer impinges directly on it.

Treatment of Infected Timber

As previously mentioned, various measures have been tried to eradicate the pest from the wharves and jetties where it has established itself. Steaming and burning the timber surface with blow-lamps was found to be quite inadequate, and the only practicable method of preserving piling is to encase the timber in concrete from below mud level to half-tide level. This process is tedious and expensive, and has the drawback that any subsequent loss of mud on the foreshore exposes the timber below the concrete casing to fresh attack, which may develope to a dangerous extent before it is noticed.



Filling Piece of Creosoted Pitch Pine bolted on to a Pile, showing the effect of Limnoria eating from below upwards.

Prevention of Attack

In an endeavour to list out existing methods of preserving timber from the attack of Limnoria and Chelura, samples of different varieties of timber were exposed just above low-water level. In each case an untreated piece was laid down with a charred, a painted, and where possible, a creosoted sample of the same timber. After three years' exposure, these list pieces give the following information:—

(1) That untreated pitch pine, Oregon pine, and blue gum are heavily attacked and should not be used in structural work below half-tide level.

(2) That charring these timbers affords some slight protection but not sufficient to justify the use of this process.

(3) That painting the surface of any timber with "Bitnamel"—a black bituminous paint—confers a high degree of resistance. It must be remembered, however, that in practical work it is not possible to secure the timbers in their position in the work without damaging the paint to a considerable extent, thus reducing the efficacy of the process. The protection afforded by an undamaged paint surface is maintained for at least three years.

(4) Creosoted pitch pine and Oregon pine is attacked though in a much lesser degree than the untreated timber, but it would appear that this material should not be used for piling and important bracing below half-tide level. Creosoted redwood has not yet been attacked, and probably owes its immunity to the greater absorption of creosote in this timber.

(5) Greenheart timber, both treated and untreated, remains immune from attack.

General Observations

It would be idle to rely on No. 5 above as representing the whole truth, since it is a well-established fact that greenheart

Greenheart—continued

timber has been attacked in almost every situation in Blyth Harbour, and conversely that other greenheart timbers in immediate proximity have remained immune. Accordingly, it would appear that there are resisting properties in certain logs which do not exist in other logs of apparently the same quality. The reasoned statements as to the rate of growth of the timber and the soil of the district whence the timber comes very probably strike at the root of the matter, but it is not an easy matter to definitely ensure that only slowly-grown logs of heavy hard timber are being supplied. A specific gravity test is of some value after the logs are on the site, but it is usually then too late to reject the timber as unsuitable. All restriction as to scantlings should be removed from a specification, and possibly it would be an advantage to definitely seek large logs on the assumption that such are likely to be from more slowly-grown trees than logs of small scantlings would be. Creosoted redwood is being used for fenders at Blyth with every prospect of a considerably longer life than either American or English elm fenders have had in the past and at a distinctly smaller cost.

The latest line of investigation is in connection with turpentine timber. A jetty in the Upper Harbour was constructed of this timber in April, 1932. The piles were driven whole with the bark left on, only such portions being squared as were necessary to enable cross-ties and bracings to be bolted on. After five years there is no trace of any attack either by Limnoria or Chelura, although they are known to be in the locality where this jetty is constructed. The various specimens of timber, treated and untreated, are kept under observation, but to get anything like reliable data to cover the whole of the experiments it may be necessary to allow a period of eight or ten years to elapse and then the results can be compared.

Legal Notes

A Quayside Fatal Accident and the Docks Regulations

(BY OUR LEGAL CORRESPONDENT)

Damages totalling £4,786 10s. were awarded against the Port of London Authority on the 15th December last, by Mr. Justice Greaves Lord in the King's Bench Division, in respect of a fatal accident to a lighterman, Mr. T. M. Hurley. The accident occurred at East Quay, London Docks, Wapping, in January, 1937, when the jib of a crane on the quay fell on to the deck of a steamer which was being unloaded. The action was brought by Mr. Hurley's widow against the Port of London Authority as owners of the crane, and against Hamburg Wharves Limited, who rented and operated it. So far as the second defendants were concerned, the action was dismissed.

At the time of the accident, Mr. Hurley was on the deck of the steamer "Lapwing," moored at East Quay. A crane, the property of the Port of London Authority, but leased to and under the control of Hamburg Wharves Ltd., was lifing cargo out of the "Lapwing" and placing it in a barge lying alongside. Without warning, the jib of the crane fell suddenly across the deck of the steamer and struck Hurley, causing fatal injuries. The immediate cause of the accident was the breaking of the wire ropes operating the luffing action of the crane, and the evidence showed that this was due to internal corrosion of the wire rope.

Bases of Action

The case is of some importance in view of the substantial amount of the damages, and there are several points of interest worthy of consideration. It will be noted that the deceased man was not in the employment of either of the defendants. The action was brought, firstly, under the Fatal Accidents Acts, which give a right to claim compensation to the family of a person whose death results from an accident caused by the wrongful act, neglect or default of another. Prior to Lord Campbell's Act in 1846 (the first of the Fatal Accidents Acts), a claim for personal injuries lapsed if the victim died. It would appear that these Acts "supplied a long-felt want," and there have been innumerable claims under them. The main question usually is whether in each particular case the accident was brought about through the negligence of the third party.

The action against the Port of London Authority was, however, also based on the recent Law Reform (Miscellaneous Provisions) Act of 1934, which is of much greater importance than its title suggests. The Fatal Accidents Acts were confined to claims for personal injury, but this Act extends considerably the principle of Lord Campbell's Act by providing that all causes of action (with certain exceptions, such as libel) subsisting or vested in any person, shall survive his death, either against or for the benefit of his Estate. The rights conferred by the Act are expressly stated to be in addition to any rights under the Fatal Accidents Acts, and the damages are to be calculated without reference to any loss or gain to the estate consequent on the death (except that funeral expenses may be included). Under this Act, the Port of London Authority has been adjudged liable for £786 more than they would have had to pay in a similar case prior to 1934.

The Law Reform (Miscellaneous Provisions) Act has resulted in considerable litigation, culminating in the case of Rose v. Ford (arising out of a motor accident), which went to the House of Lords for final decision. Until this decision, there was uncertainty and difference of opinion as to the nature and amount of damages which could be claimed under the new Act in cases of personal injury to which Lord Campbell's Act already applied. As a result of Rose v. Ford, it is now established that in addition to the claim by the family of a person killed in an accident to which the Fatal Accidents Acts apply, the Executor or Administrator, of the deceased may be awarded substantial damages for the benefit of the deceased's estate in respect of matters, such as pain and suffering and shortened expectation of life, for which claims did not formerly survive the deceased. In the case of Rose v. Ford, the damages finally recovered were: £300 under the Fatal Accidents Acts, £1,022 under the new Law Reform Act, and £29 funeral expenses. It would therefore appear that the Port of London Authority might have suffered more heavily than they did on the second count.

Docks Regulations

A third statutory provision played an important part in the case under review. This was the Docks Regulations, 1934, familiar no doubt to most readers. The Regulations were made by the Home Secretary, pursuant to the Factories and Workshops Acts, for the safety and protection of those engaged in handling cargo at ports. Part III of the Regulations relates particularly to the testing and inspection of lifting gear, and accessories, and compliance therewith is the duty of the owner of the machinery or plant. Regulation 20 (b) in Part III provides that every wire rope shall be inspected once at least in every three months. It was admitted that the luffing wires of the crane at East Quay were last previously inspected on the 24th September, 1936, whereas the accident to Hurley occurred on the 7th January, 1937, so that a period a fortnight longer than the prescribed limit of three months had elapsed without an inspection.

The evidence was not very conclusive as to whether, had an inspection been made at some time within the three months, the fatal defect would have been discovered, but the Judge held that the Port Authority, as owners of the crane, had failed to perform their statutory obligation and so were answerable for the consequences. Cases have been referred to in these columns where the liability of Dock and Harbour Authorities under the Common Law depended upon whether or not their duties had been carried out with reasonable care—obviously a standard of performance difficult to define. In the present case there was no uncertainty, but a definite obligation to do a certain act within a specified time, and the case serves as a sharp reminder to all Dock and Harbour Authorities of the necessity for strict compliance with the exact requirements of the law.

Shipping Tonnage at British Ports.

The preliminary figures for 1937, showing the net register tonnage of vessels which used the principal ports of the United Kingdom, are as under:—

	Net. Reg. Tons	
	1937	1936
London	62,648,993	62,151,310
Liverpool	35,374,217	34,281,699
Southampton	27,547,620	25,712,142
Hull	12,312,305	11,902,421
Manchester	7,674,682	7,775,619
Bristol	7,457,108	7,319,182

Bombay Port Trust.

At a meeting of the Trustees of the Port of Bombay held in December last, it was announced that the Chairman, Mr. Charles Wiles, C.S.I., C.I.E., has been appointed to the position of Chief Secretary to the Government of Bombay, with effect from 1st January, 1938.

Rear-Admiral H. Fitzherbert, C.B., C.M.G., R.N. (Flag Officer Commanding, Royal Indian Navy), has been appointed a member of the Board of Trustees in place of Admiral A. E. F. Bedford, C.B., C.S.I., R.N., who has resigned.

The Board approved a reduction in the Wharfage Rate for Petrol in Bulk, subject to the sanction of the Government, and a number of estimates for expenditure were sanctioned.

The Port of Bordeaux and the Estuary of the Gironde

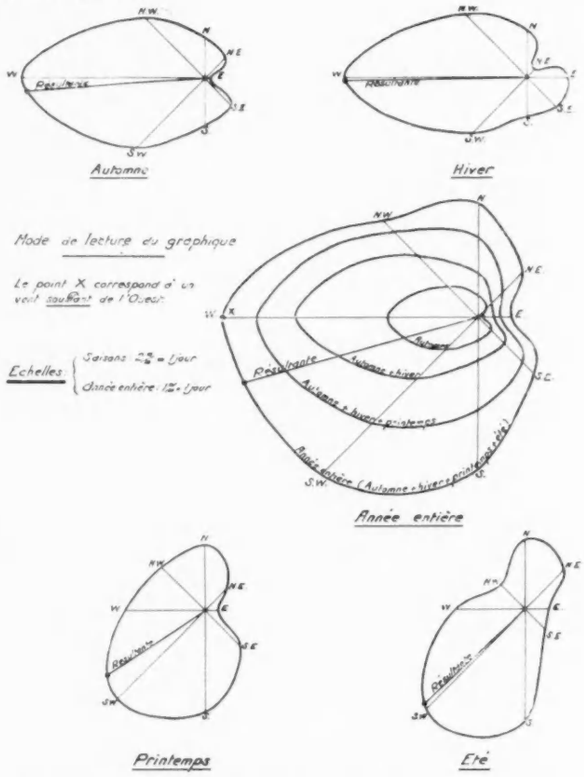
By M. F. LÉVÊQUE, Chief Engineer and Director of the Autonomous Port of Bordeaux

(Translated from the French)

(continued from page 55)

Effect of Storms on a Sandy Channel

WHEN a channel exists, or forms itself or is cut, in the W.-E. direction, through a crescent like that of our bar, the two sides of the opening on the seaward side are subject to attack by storms. For instance, a storm from S.-W. erodes the northern side and silts up the southern one, and conversely as regards storms from N.-W. On the other hand, storms from W. have little effect on the opening.



Le Verdon: Direction of Wind Observations from 23rd September, 1932 to 22nd September, 1933. Curves of Frequency and Resultant of Wind Directions.

This simple explanation agrees with the fact that the old northern channel which was clearly running from N.-W. towards S.-E., had an increasing tendency to assume a N.-S. direction, as the more it was shifting to the north, the more the effect increased of storms which were silting up its southern side and eroding its northern one. The calculation of the cube of the bar, commenced by Volmat and continued by us, clearly confirm this view, as well as the slowness of variation of bottom on the bar itself.

The Genesis of the Solution Adopted for the New Channel: The Psychological Problem

We have ultimately been led to consider whether the W.-E. direction, which would approximately bring about an equivalence of the resultants of storms from the S.W. and from the N.W. sectors, would answer the requirements of the river.

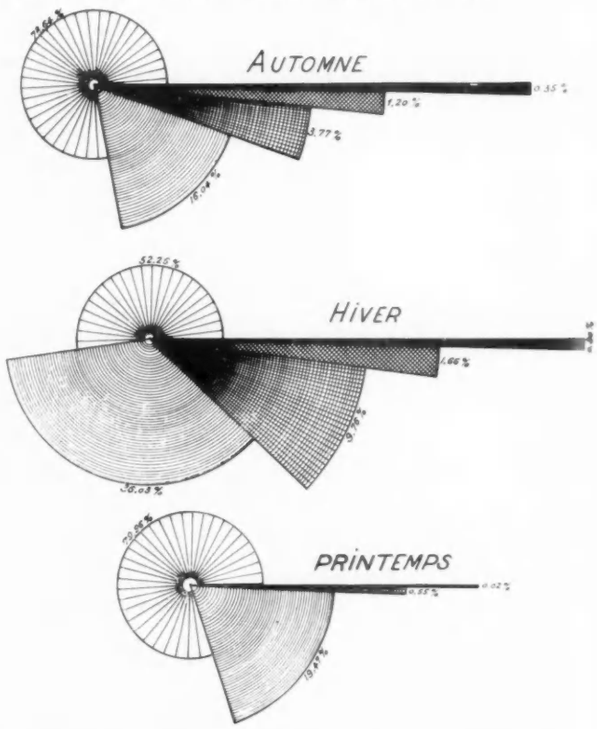
In the absence of sufficient data, it has been necessary to call imagination into play, but in so doing the general principle laid down by the great geometrician Fermat has been borne in mind, that nature proceeds by the shortest and easiest ways, following the line of least resistance.

We have thus been led to think that the W.-E. diameter of the circular ring which constitutes the external bar, forms a symmetrical axis from the marine point of view, as it does from the geometrical point of view. This, at the time, amounted to the attribution to it, by intuition, of particular properties, and to proceeding, so to speak, by extrapolation, in relation with the then known data concerning the river. This extrapolation was continued, with the desire to be able to prolong this diameter by an extended alignment of the channel towards Verdon and the interior of the Gironde, as though the selected diameter could be assimilated to a luminous ray, reflecting itself, with the curvatures always given by nature, in the direction of Verdon and Pauillac, upon the limestone cliffs of the Charente coast, between Royan and La Coubre. There was some similarity to such reflection in what is already seen roughly and imperfectly in the primary flow of the tide and in the movement of the ocean swell or storm waves from W. or S.W.

This hypothesis was adhered to, but with great anxiety until it could be ascertained that the currents of the river, whether at ebb or flood, followed the same course as the storms from the West.

Nature had decreed that there should be a practically common direction in which the main currents of flow and ebb spread themselves from the external edge of the bar, and that this should coincide with W.-E. From the external edge of the bar, we come at once, as regards currents and tides, under marine conditions. When we get within the crescent of the bar, we are under river conditions, flood and ebb being in juxtaposition, but with predominance of the ebb which has a speed practically double that of the flood. This is particular to the Gironde, a river certainly far advanced in its evolution and approaching hydraulic equilibrium as we understand it to-day.

When we began our work we had discouraging criticism from certain well-known engineers. But here, in this country of Montaigne, we know that often "things accepted as undoubted only rest upon grey-bearded and wrinkled custom."



Le Verdon: Force of Wind Observations from 23rd September, 193. to 22nd September, 1933. Graphs of Frequency and Velocity at different seasons.

In the past, engineers had mainly to deal with old problems and to give to questions, quietly put, the stereotyped reply. To-day, we are in an era when questions and difficulties arise on the most unexpected points and when a prompt solution is expected. In particular, it has become necessary to deal thoroughly with the great forces of nature, in the first place

Port of Bordeaux and Estuary of the Gironde—continued

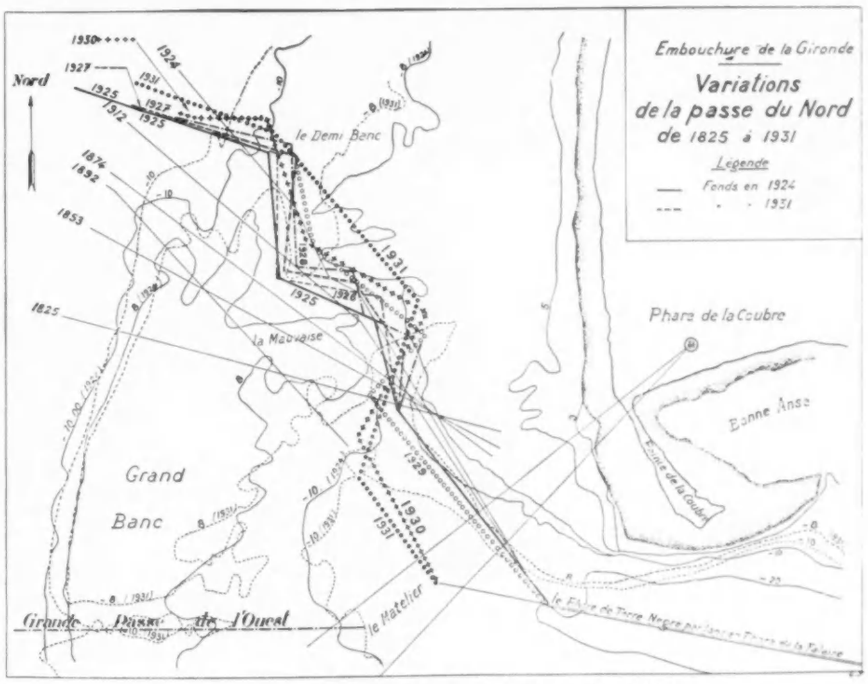
with the sea. The big modern ship calls irresistibly for the big modern channel.

Estuary Discharge

In effect the Gironde Estuary may be looked upon as follows:—

The internal part, above Pointe de Grave, is still in a comparatively wild state. It comprises banks anchored to a solid or consolidated subsoil, and covers a width of 8 to 11 kilometres. It is constricted by a marine bolt analogous to a glacial bolt and contained between the limestone of Pointe de Grave and the cliffs of Saintonge. This bolt has the obvious effect of concentrating the strength of the river within a width of less than 6 kilometres. During the ebb, the river rushes with increased power, and practically in a straight line, against the cliffs below Royan. On its being progressively deflected by them, it finds the present channel, exactly in E.W. direction, which it maintains as its regular channel of exit, and which irregular storms try to modify, but up to now have not seriously affected.

It is to be noted that the narrowing at Pointe de Grave is continued between the rocks of Cordouan and the coast of Saintonge and is accentuated seaward of the Cordouan plateau, between the reefs on the South and the Pointe de la Coubre on the North, into a channel of about 3 kilometres average width. This forms a sort of nozzle leading the currents into the sea with the least loss of effective strength. The importance of this will be appreciated when it is remembered that, where the Amazon flows in a single channel, it is 3 to 4 kilometres wide by 30 to 40 metres deep, conditions which seem comparable with those of the purely marine section of the Gironde.



Variations of the North Pass between 1825 and and 1931.

The Southern Channel at High Water
The Tides

As we have seen, this funnel formation at the river's mouth has only one defect: that is, the Southern channel, which the flood tide enters before it enters the W.-E. channel, as appears from the cotidal curves showing the time of high water at successive places and intervals.

According to Manen, when the tide reaches the mouth of the river, the flood wave, which approaches the coast of the Landes more or less at right angles up as far as Pointe de Grave, is subjected, except at the entrance to the Southern channel, to a retardation caused by the rocks of Cordouan. This causes it to approach the Great Bank from the S.W., and to flow for a time in a more or less S.-N. direction, towards the islands of Charente. The flood therefore enters by the Southern channel at least an hour before it passes between the rocks of Cordouan and the Pointe de la Coubre by the new W.-E. channel. There is therefore, at the entrance of the estuary, a primary flood from the Southern channel, followed by the main flood which runs into the great external navigation channel of Saintonge. The flood and ebb counteract each other a little opposite the Pointe de Grave jetty.

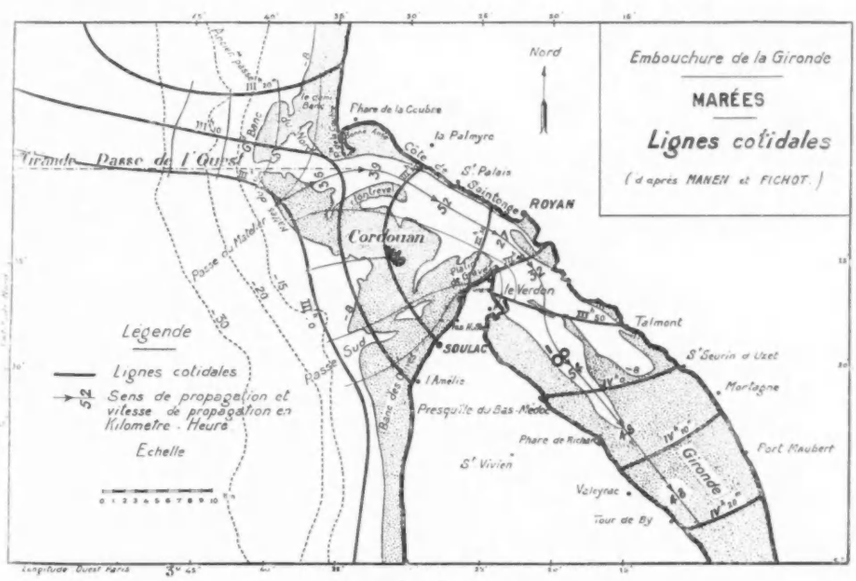
The tidal undulations, like storm waves and the ocean swell, pivot round the Pointe de Grave and are deflected at the same time in front, towards Royan, before entering the estuary. The cotidal curves show clearly a retardation at the pivoting centre, that is to say, at Pointe de Grave, which explains the longer duration of the ebb in the whole of the Verdon roads. The movement thereafter becomes regular and the crest of the tidal undulation, overtaken by the more rapid direct wave coming through the new channel, becomes again perpendicular to the general longitudinal axis of the internal river. We have here a concrete example of the well-known pivoting of waves, complicated by a reflex action in general accordance.

To say much more on the tide question would require a special article to itself. The typical tide curves are very regular. They are almost symmetrical at the river mouth and straighten up more and more, on the ebb side, in the up-river direction. Their amplitude is more or less equal at the mouth and at Bordeaux, which is characteristic of a river whose evolution is almost complete.

Up to the present, it has not been necessary to contemplate works on the Saintonge shore. If these should one day become necessary, the first to be done would be the revetment of the cliff face against which tides, waves and currents are deflected in their course. Next would come the closing of the Southern channel, between Pointe de Grave and Cordouan, so as to form a guide bank for the real river which flows out into the sea opposite La Coubre. Such a spur would bring about the silting up of several thousands of hectares south of the work itself, as far as St. Nicolas and Soulac.

We have, in fact, in three summer seasons—1930-31-32—opened a W.-E. channel about 1 kilometre wide and 4½ kilometres long, with depths of from 9 to 11 metres below zero. The ebb current here has been intensified by at least one-tenth since the opening of this cut in the Great Bank.

As shown on the chart recording observations of currents by means of floats, the flow and ebb currents are now, in the dangerous external zone of the channel, exactly parallel with the W.-E. axis of the channel, and scarcely exceed 2 knots on the ebb.



Tides: Co-tidal Lines.

Port of Bordeaux and Estuary of the Gironde—continued

Since August, 1932, no dredging of any kind has taken place, and during more than three years the channel has maintained itself " against wind and tide," in literal truth. The sea practically breaks in it no longer, and the channel which, ten years ago, was approached with great caution by mariners, has become extremely easy of access, and safe. It is in any case the most important channel of its type in the world, even more so than the Ambrose Channel at New York.

The Navigability of the New Channel at —9.50
The Future of the New Channel

At the present time, the channel throughout has a depth of —9.50 below zero of marine charts, for a width of 600 metres, and a large proportion is lower than —10.

This channel offers interesting possibilities from the point of view of navigation. The tidal curves appended show the movement of the surface, from a given point in the channel, under the influence of tides with varying coefficients, over a bottom of 9 m. 50 below zero of charts. This zero is lower than low water by a depth varying from 0.50 m. to 2 m. 50, according to the coefficient of the tide. A ship must have beneath its keel a certain depth of water so as not to be liable to touch bottom under the action of the waves. This depth is called " the pilot's foot." At Havre, it is less than 1 m. 50, even for ships of the deepest draft. The danger of touching, however, is less in proportion to the length of the ship. Thus a ship 300 m. long will always be supported by many waves on the bar of the Gironde, where the crests of the waves are at intervals of between 50 and 90 metres.

Let us assume a " pilot's foot " of 1 m. 50 and the present depth of 9.50 below zero of marine charts. The distance between the water-line of the ship and the bottom must therefore equal at least the ship's draft, plus the " pilot's foot."

Within the zone of —9.50 below zero, the biggest ship of to-day, " La Normandie," with a draft of 11 m. 20, has in the channel at least 1 m. 50 under her keel during a period around the time of high water and comprised between—on neap tides (coefficient 34)—3 hrs. 25 m. before and 3 hrs. 20 m. after high water, or 6 hrs. 45 m., and—on spring tides (coefficient 110)—3 hrs. 15 m. and 2 hrs. 45 m., or 6 hrs. Assuming a pilot's foot of 2 m., the corresponding figures would be 4 hrs. 35 m. (neap tides) and 5 hrs. (spring tides).

The largest German ships of to-day (" Bremen " and " Europa "), having a draft of 9 m. 75, have, during any tide, at least 7 hrs. 40 m. to enter into the Gironde with at least 1 m. 50 below keel. At high tide, the depth of water under keel varies, for the same German ships, between 3 m. and 4 m. 50.

The new channel is therefore quite suitable for the entry into Verdon of the largest ships, either afloat or under construction.

What will be the fate of this W.-E. channel? Discretion is advisable when one is dealing with the phenomena of nature, which have time on their side. The future alone can answer.

The present situation marks a stage in the evolution of the Gironde. It does not express finality, but a passing condition within the meaning of geological time. Pierre Termier has said: " A million years are required to begin to do something in geology." We shall not go quite so far as that. We shall pass on the torch to our successors: it will be theirs to keep on the watch.

Are we, as Victor Hugo said, bold pygmies who have overcome senseless giants of the sea? Have we in our turn had the help of that same little imp who attended Socrates and who never told him what he ought to do but merely held him back from doing what he ought not to do?

We can say, at all events, that we have not remained in human impotence, prostrate under the weight of nature. We have, so to speak, by a series of gropings in the dark, negotiated with the Gironde. It seems that she is ready to accept, in its general lines, the channel which we have discreetly offered to her, with a view to endowing her with stable equilibrium in accordance with her antecedents and with her fluvial constituents.

Our new Western channel is not one of an unstable type. It is not a case of abnormality among the world's channels; and when we have faith in its relative stability in time and space, we are not suffering from that " intoxication by energy, haste or largeness of dimension " which M. Paul Valery sees in the manifestations of our generation of strife and achievement.

We have been ambitious perhaps, but as M. Duhamel has said, " Ambition is an exhilarating passion."

(To be continued).

Metallic Corrosion in Sea Water

The Deterioration of Muntz Metal at the Port of Maryborough, Australia, and the Remedial Measures Adopted

The following is an extract from the Engineering Section of the Report of the Department of Harbours and Marine, Queensland, 1937. The Report is signed by Mr. D. Fison, the Harbour Branch Engineer.

For many years muntz metal in contact with sea water has been subject to a form of decay which was of rare occurrence in the earlier manufactured metal. Many avenues of research, suggesting a probable solution of the cause, have been exhaustively investigated without success.

In former times, i.e., prior to about 1900, muntz metal used for pile sheathing in wharves and jetties would last as long as the timber superstructure. A certain amount of the metal dissolved very slowly away (by exfoliation), but the remainder retained its originally tough character to the last. The decay of more recently manufactured muntz metal (dezincification) may render a sheet completely rotten in a few months without apparent diminution of its thickness and sometimes without alteration of its appearance.

The changed behaviour of muntz metal dates from the introduction and use in its manufacture of electrolytically refined copper; but a return to fire-refined copper has met with indifferent success. It has been shown by analysis that some at least of the older metal had in it traces of gold left in the imperfectly refined copper used. It has been suggested that this acted as a negative catalyst to the process of decay.

The deterioration of muntz metal in sea water is an electrochemical action. At Urangan jetty it was found that whilst all the wrought muntz metal, including bolts and sheets new and old, was in various stages of decay, the cast muntz metal bolt nuts, cast washers, and nails were invariably sound, showing no deterioration whatsoever. This cast metal was, on analysis, found to be too high in copper content and electrically cathodic to the wrought metal. All bolt shanks for replacements were subsequently made of cast metal. The original bolts were made from rolled or extruded bars.

Although the electrolytic action going on throughout the whole under-water structure could not be stopped, it was possible to prevent the rapid decay of new sheets by insulating it as much as possible from the old work. It was the former practice in repair work, either to nail the new sheets or patches directly on to the broken or decaying portions or to insert stockholm felt between. This method of patching the old original quality metal was quite satisfactory, but it simply promoted the destruction of new metal applied to dezincified metal. The decayed sheet, through loss of zinc, being now rich in copper and strongly cathodic to the new metal, its decay was stayed at the expense of the new metal, which perished immediately.

Although perfect insulation of new metal from the old, or each sheet from its neighbour in new work, is impracticable, still electrical resistance between sheets can be enormously increased at very little expense. This practice has given encouraging results, and it is thought that, with such insulation carefully done, muntz metal may again find favour in the protection of timber piles in sea water.

The method of insulating the sheets or patches is as follows: A composition well known in shipbuilding practice (coal tar chunam) is prepared by mixing coal tar and fish oil in the proportion of two to one, and thickening to the consistency of butter with finely pulverised whitening (ordinary lime is often used in the preparation of chunam, but, unless it is very carefully air slacked, changing it from hydrate to carbonate, it is quite unsuitable). Chunam properly prepared is not only indestructible in sea water, but it retains its plastic nature indefinitely when completely immersed.

The sheets, after being shaped to suit the curvature of the pile, are coated with the chunam on the inside to about three-sixteenth of an inch thickness, right out to the extreme edges; stockholm felt of the same size as the sheet or patch is then sewn on over the chunam through the nail holes previously punched. When the sheet is nailed on, the chunam squeezes into the felt and through to the nail holes, forming a fairly perfect insulation. At worst the sheet can now be subject to electrolysis from the outside only; formerly, the greatest action was from the inside face of the sheet.

The Port of London Authority Police

By W. H. A. WEBSTER, C.I.E., Barrister-at-Law
(Chief Police Officer, Port of London Authority)

JUST as the visitor who is privileged to visit for the first time the docks of the Port of London never fails to express amazement at their vastness, and usually has to add a confession of his complete ignorance till that moment of their existence, so, no doubt, readers of this Journal, even if vaguely aware that there are some Dock Police in London, will learn with surprise that the Port of London Authority employ for the purpose of policing their docks a force which is numerically greater than that employed by the great majority of the counties and cities of England. Yet such is the case, and in the following pages an attempt will be made to give the reader an account of this force, of its origin, its present-day composition, and its duties.

The total length of P.L.A. Police Beats is 166 miles. Traffic Duties are included in the work at the Docks.

When the Port of London Authority came into existence in 1909, it took over, along with the rest of the Dock Companies' personnel, their Police. There were three separate forces in existence aggregating some 440 officers and men. In due course the newly-formed Authority turned its attention to the work of re-organisation and after preliminary investigation during the course of which a suggestion to hand over to the Metropolitan Police the policing of the docks was examined and negatived, the Authority set about the task of welding the old Dock Companies' Police into one force. The first step was the creation of an appointment of Chief Police Officer, and the first holder of this position was Mr. E. C. Stuart Baker, C.I.E., O.B.E., J.P., who had previously held the post of Deputy Inspector-General in the Indian Police. This was in 1912, and the work of reorganisation went on. It was, however, greatly hindered by the outbreak of the Great War, to the call of which no fewer than 284 reservists of the Authority's Police responded, of whom 62 made the great sacrifice. By 1921 the numbers of the P.L.A. Police had risen to 1,035. These years, too, witnessed a vast change in the conditions of service. The pay of a constable, which was only 23s. a week in the old Dock Companies' days, was raised, as was also that of all other ranks. A pension scheme was introduced; the hours of duty which, under the previous organisation, were frequently 10 or 12 at a stretch, were reduced to 8 hours a day; a leave system was devised and the weekly rest day instituted; rules were drawn up governing the grant of leave and pay during sickness and an adequate reserve of strength allowed to fill leave and sick absences. Hence to-day the P.L.A. police constable is, with the exception of having to serve somewhat longer to earn his full pension and of not being granted free quarters or lodging allowance in lieu thereof, as well off as his opposite number in the Metropolitan or City Police in London.

Subsequent reviews of police requirements in the docks have led, in the interests of economy, to some reductions in strength, and the present strength of the force is 567, made up of:—1 Chief Police Officer, 1 Superintendent, 1 Chief Inspector, 5 Divisional Inspectors, 23 Inspectors, 42 Sergeants, and 494 Constables.

For police purposes the docks are divided into five groups, each in charge of an officer of the rank of Divisional Inspector. There is a police station in each group, and the force attached to each is allocated according to local requirements. At first sight it might appear that this is an extremely large force to employ, mainly for watch and ward duties, in a city which already is admirably policed by the Metropolitan and City of London Police forces; and here it may not be out of place to remind the reader that the Port of London Authority do not police the River Thames. The writer on his appointment imagined that a pleasant part of his duty would consist in cruising up and down the river in a smart launch, but speedily learnt that the river was policed by the Thames Police, who form a Division of the Metropolitan Police.

Over 3,000,000 tons of Goods are passed over the Dock Quays annually, all of which has to be protected against pilferage and fire.

The docks administered by the P.L.A. have a land area of 3,521 acres, a water area of 721 acres and 45 miles of quayage. The tonnage of shipping which used the docks during the year ended 31st March, 1937, was over 32,000,000; the tonnage of export and import goods passed over the quays in that year exceeded three million, a large part of which had to be stored for a longer or shorter period in the warehouses of the Authority; and the number of employees of all kinds at work in the docks daily is upwards of 20,000. An area so extensive and containing millions of pounds worth of valuable goods naturally requires considerable protection to prevent, especially, pilferage and fire; and it is to afford this protection that, in the main, the Authority finds it necessary to employ so strong a force.

Port of London Authority Police—continued

A word as to the lay-out of the docks: each group is surrounded by a wall or fence and, in all, there are no fewer than 92 entrance gates and 17 water entrances. Every one of these is manned by police, and the interior of the docks is patrolled day and night by police patrols, the total length of whose beats is 166 miles. The essential principle observed in dealing with the merchandise of the port is that no goods, ships' stores, personal effects—whether of passengers or crews— or any other property whatever, may leave the docks, whether by land or water, unless covered by a pass duly signed by an official having authority to sign, and where dutiable goods are concerned countersigned by H.M. Customs, on which is shown the number and description of the articles which it is desired to take out of the dock. The most important duty of constables at gates and river entrances is to collect these passes, see that the greatly simplifies the task of preserving order and preventing obstruction in the docks during times of strikes. To the protection afforded by the fact that the docks are enclosed, as also to the excellent system whereby all the gates are linked up by telephone, not only with each other but with the Dock Police Station, we also owe, no doubt, in a large measure, our comparative immunity from the serious crime of warehouse breaking.

Besides the protection of property and prevention of pilferage and fire, the P.L.A. Police have to investigate crime that occurs in the docks and, for this purpose, there is a Criminal Investigation Department consisting of a Chief Inspector, four Detective Inspectors and fourteen Detective Sergeants and Constables. As might be expected, larceny, often in the form of pilferage, is the commonest type of offence dealt with.

Left: Fitting a "Boddy" Waistcoat as worn by P.L.A. Police during Fog. Right: Carrying out the Annual Test of "Boddy" Waistcoats.

signatures are correct, and compare the number and description of the articles mentioned in the pass with those on the van or barge, or in the hand of the person who presents the pass. The pass system is a very intricate one and needs considerable study, as will be understood by a mere mention of a few of the types of passes that are in use: Authority's, baggage clearance, demand pass, brought-in pass, grain pass, mate's pass, sample pass and tenant's pass. Besides the checking and collecting of passes, a most important part of the duty of a gate constable is the scrutiny of persons entering and leaving the docks. The docks are private property, and the Authority have the right to refuse admittance to persons having no legitimate business in them. Section 66 of the Metropolitan Police Act of 1839, by which constables are empowered to stop, search and detain persons reasonably suspected of being in possession of stolen property, and vehicles or boats on which there is reason to suspect that stolen property may be found, has been extended to the docks; and it places an extremely valuable weapon in the hands of the Dock Police for preventing persons from taking out of the docks pilfered property concealed about their persons.

Beat duty in the docks is very much the same as beat duty anywhere else. Sheds and quays are patrolled. All appliances for the prevention of fires and the saving of life—such as ambulance and telephone call boxes, fire hydrants, lines and drags, etc., are examined to see that they are in working order; and at night the fastenings of all premises on the beats are examined. In addition, traffic is regulated, order maintained and the beat constables are the principal agency for seeing that the Authority's by-laws, which number about eighty in all, are correctly observed. More important still, by their presence on the quays and in the warehouses where cargo is being handled, they act as a great deterrent to pilferage. Dock Police, unhappily, have had considerable experience in handling strikes. The fact that the docks are surrounded by walls or fences

The prevention and detection of cargo pilferage is one of the principal concerns of the Dock Police. The difficulties are great. One of them lies in locating exactly where the pilferage took place. Although a case of whisky, opened in the docks because it seemed to be suspiciously light in weight, is found to be six bottles short, it does not follow that the whisky was abstracted in the docks. It may have taken place in the manufactory, or en route to the docks by rail, water or road; cargo pilferers are extremely clever at opening and re-coopering cases without leaving any trace, and only careful examination, which usually it is impossible to give within the time available, will reveal that they have been tampered with. Similarly, when a ship is discharged in South America and cases of cargo are found to have been broached, it is almost impossible to say if the pilferage was done by the labourers who did the unloading at the port of destination, or by those at intermediate ports of call at which the hatches were opened, or by the crew or by the stevedores at the port of loading.

Detectives called in to investigate cases of this kind where they are far from sure if the theft occurred within hundreds of miles of the area in which they have jurisdiction are in a peculiarly helpless position, and it is not to be wondered at if in many such cases their efforts are mainly concerned with seeing if the known facts do not indicate that the pilferage took place somewhere else. Another great handicap to successful police action is the difficulty of getting information. Though the majority of dock labourers may be honest, and though it is impossible for the dishonest minority to commit pilferages without the knowledge of their mates, it is very rarely that the latter will give them away. This reluctance to give information is largely due to the fear of reprisals; but to one used to police work overseas, it is strange to find offers of money rewards and promises not on any account to divulge the informant's identity producing so little result. Happily, it may be said without fear of contradiction that pilferage on anything like an organised

Port of London Authority Police—continued

scale is decreasing so far as the Port of London Authority's Docks are concerned. One reason for this is that the "scrounging" habits, which were so rife in the years immediately after the War, have largely disappeared. Another, and no doubt the main reason, is that the dock labourer to-day is better paid and altogether a better class of man than the old docker used to be. The tendency nowadays is to replace casual labour by permanent men whose jobs are regular and well paid. Such employment is worth keeping and not to be lightly risked for the sake of a bottle of whisky or a yard or two of silk.

Next in frequency to larceny cases come infringements of H.M. Customs Regulations. Most of these are discovered in the course of searches at dock gates. Here it might be well to correct a common misapprehension that the Dock Police have a great deal to do with the prevention of smuggling. That, primarily, is the work of H.M. Customs, a large number of whose officers are employed in the docks. Between them and the P.L.A. Police exists close co-operation, but it will be understood that the P.L.A. Police is not a Crown force, and its principal pre-occupation is with the duties that directly affect the Authority and its interests. We form, however, a very good second line of defence against the activities of smugglers, and H.M. Customs would be the first to admit that this is so.

At each of the five Dock Groups there is a Police Club. The P.L.A. Swimming Club Gala held at West India Docks.

Next in numerical importance come prosecutions of stowaways, assault cases and drunkenness, and, in addition to other miscellaneous offences, including confidence men on big liners, a number of prosecutions have to be made for infringements of the Authority's by-laws. The Authority's police do not prosecute their own cases, and the procedure followed is that after a case has been investigated by the Authority's detective staff and an arrest made, the prisoner is handed over to the nearest Metropolitan or City of London Police Station, where he is charged, and the subsequent prosecution is carried out by the Metropolitan or City Police.

Prior to the passing of the Port of London (Consolidation) Act, 1920, the Authority's Police were sworn in under the Harbours, Docks and Piers Clauses Act, 1847, Section 79, of which enacted that:

> "Any two justices may appoint such persons as shall be nominated for that purpose by the undertakers to be special constables within the limits of the harbour, dock, pier, and premises of the undertakers, and within one mile of the same; and every person so appointed shall be sworn in by such justices duly to execute the office of a constable within the limits aforesaid, and when so sworn in shall have the same powers, protections, and privileges within the limits aforesaid, and shall be subject to the same liabilities, as constables have or are subject to by the laws of the realm."

With the passing of the Port of London (Consolidation) Act, 1920, power to appoint constables was given to the Authority, and the wording of Section 128 of this Act closely follows that of the relevant section of the earlier Act, with the exception that the word "special" before "constable" is omitted. Men appointed to the force since 1920 are sworn in under the new Act. The standards of height, age, character and physical fitness for appointment to the Authority's force approximate to those in force elsewhere in this country. Candidates have to undergo a preliminary examination to test their educational fitness and, if successful, are posted to an instruction class for ten weeks, during which they are put through a course of instruction on the lines of the Metropolitan Police recruits' course at Peel House. If they succeed in passing out successfully at the end of this course, they are drafted to Divisions and remain on probation for a further period of six months, during which they are required to pass two further tests. All recruits must possess a certificate of ability to swim, and for those appointed after 1928 it is a condition of service that they must obtain the certificate of the Royal Life Saving Society that they are proficient in the methods of saving life of those in danger of drowning. One hundred and two members of the force who underwent the course voluntarily are already the holders of this certificate or of higher qualifications. All ranks are also required to be trained in First Aid work and to pass the examination of the St. John Ambulance Association, and the Authority provides four motor ambulances for accidents occurring in the docks, each with a driver and ambulance attendant found from the police force.

The force possesses its own Instruction Book which, besides containing all the instruction in law and police procedure that is necessary for a police constable to know, deals also with the multifarious duties peculiar to dock police. With reference to these regulations, it may be not without interest to record the fact that long before the Authority came into being the old Dock Companies were alive to the desirability of providing their police with an instruction code, and a copy of the St. Katharine Dock Police Instruction Book, dated 1839, contains much that is not without value to-day, although, as may be imagined, many changes have occurred since then. The Chief Police Officer, for example, is not now provided with apartments in the docks consisting of "a sitting room, bed room, kitchen, and bed-place for a female servant!" To modern eyes the standards of discipline in force in those days appear to lack consistency. To-day we would think that a scale of fines for being found asleep on duty ranging from half-a-crown for a first offence, and rising by varying amounts to fifteen shillings for the sixth offence, erred on the side of leniency, to put it mildly. On the other hand, a prohibition against constables on duty at dock gates entering the lodge for clerical purposes, with the explanation that a desk was provided outside for the purpose, and that if the ink were frozen or the constable's fingers numbed with cold, he might sign his passes in pencil, seems unduly harsh!

In conclusion, lest it be thought that it is a case of all work and no play in the P.L.A. Police, a brief mention must be made of the sporting and social side. At each of the five groups of docks there is a police club with its canteen, billiard room and concert stage, and, in common with other branches of the Authority's staff, the police have the use of the fine sports ground of twenty-nine acres and pavilion provided by the Authority at Ilford. There are inter-dock police competitions at cricket, football, swimming, walking, boxing, billiards, tug-of-war and drill; and while we hold our own in open competitions at these various sports, we have excelled of recent years at boxing and walking.

Qualifying Examinations for Studentship of the Institute of Transport.

The Council of the Institute of Transport has extended the list of examinations which it recognises as qualifying for admission to studentship, by the addition of the Board of Trade Examination for Second Mate.

Deepening of Fish Docks at Grimsby.

In view of the larger number of deep-sea trawlers using the Port of Grimsby, the London and North Eastern Railway has decided to deepen No. 1 and No. 2 Fish Docks, in order that the depth of water available shall correspond with that in the new No. 3 Fish Dock, which was opened in 1934. This will ensure that the large trawlers used for fishing in the deep-sea fishing grounds around the Faroe Islands, Iceland, Bear Island, the Norwegian Coast and the White Sea, shall be able to use the whole of the accommodation available for the fishing industry at Grimsby Docks. The scheme will involve the deepening of the water level in these two docks by 3-ft. 6-in., and the work is to be put in hand immediately.

Book Reviews

Deep Diving and Submarine Operations: a Manual for Deep-sea Divers and Compressed Air Workers. Compiled and edited by Sir Robert H. Davis. Pp. 510. Price: 18s. net. —London: The Saint Catharine Press.

There is perhaps no enterprise of an adventurous character so fascinating and attractive to the mind as that of diving into the depths of the sea. It is paralleled only by exploratory flights into the realms of the air, but in this case, the art has become so common and is practised so widely, that it has lost much of its early mystery and has become an ordinary feature of modern experience. And whereas the number of those who have travelled by air now totals hundreds of thousands, the hidden depths below the surface of the sea have only been penetrated by relatively few.

In his work, which has now reached a fourth edition, Sir Robert Davis gives an extremely complete and graphic account of the art of diving, dealing not only with the general methods of operation, but with the scientific aspects of the matter and all its attendant problems. There is an account of diving as practised in its simplest and rudimentary form by naked men in search of pearls and sponges, followed through all the stages of development to the elaborate and complicated outfit of the workers engaged in the tracing of the liner "Egypt" which, with a million pounds in bullion on board, sank in 1922 off the French Coast at Ushant, in a depth of some 400-ft. of water. Perhaps even more remarkable, in view of the great depth to which it descended in 1930, is Dr. Beebe's steel bathysphere. The depth (not given in the manual) as recorded in the "Scientific American," was 1,426-ft.

Leaving aside these absorbing and romantic features, the essential contents of the volume may be briefly summarised as follows: Chapter I deals with the physics and physiology of the subject. Then follow three chapters dealing with the normal use of the diving dress, with another chapter on first aid to the diver in the event of illness or accident. Passing then to chamber and bell diving, there is a description of the Davis' Submersible Decompression Chamber, including the latest decompression system and a series of decompression tables, as also an account of the ordinary diving bell used in harbour construction works. Self-contained and armoured apparatus are next discussed, together with submarine observation chambers. The practical aspects of diving are considered in connection with the under-water cutting of metals, rock blasting and wreck removal by explosives. Even the contingency of disabled submarines is dealt with, and the methods of escape which can be employed in such cases.

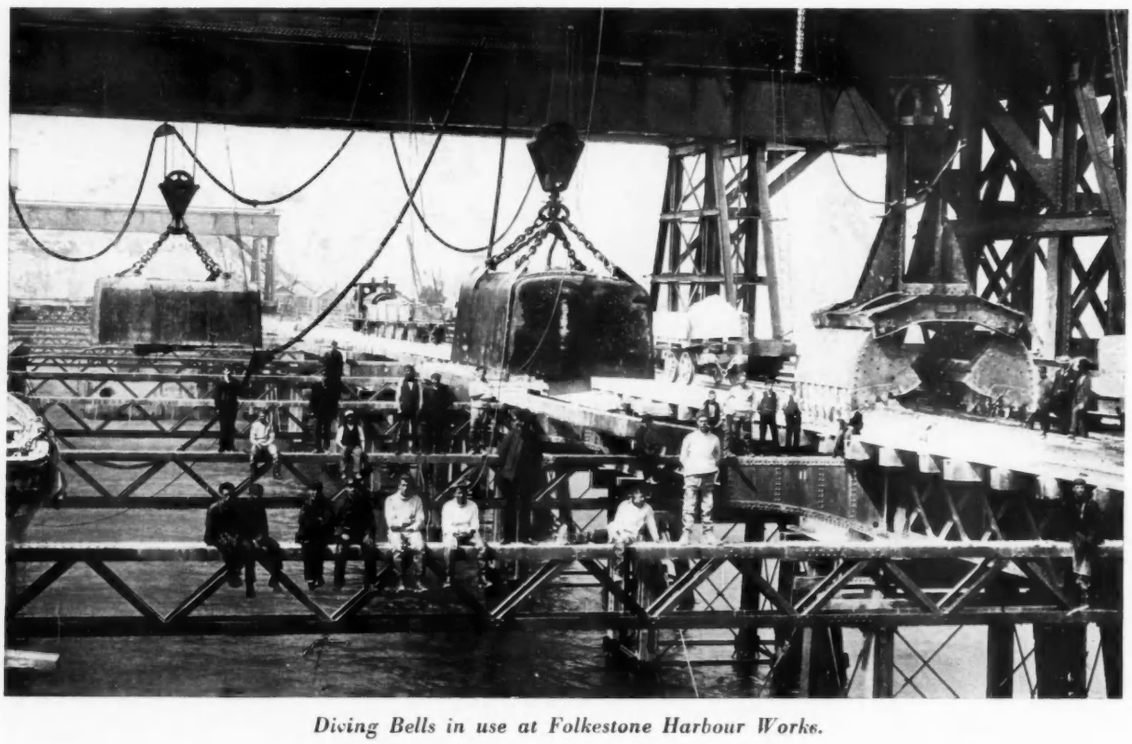
The book is not without lighter passages, and we cull the following extract as an example of its occasional humour.

"The Diver's Testimonial. Many divers are leg-pullers of the first degree. The following epistle, with an illustration of a diver, appeared in a full-page advertisement in a weekly paper with a very large circulation:—

"'I feel it my duty to write to you after having derived great benefit from the use of your cocoa. I have been twenty years in the Navy, so naturally have a tired feeling after work.

"'Whilst cruising the other day, one of the blades of our propeller came off, and I had to go down **and solder a spare one on.** It was rather a long and tiring job, and I sincerely believe that if it had not been for your cocoa, I should never have got through it."

Fully half the volume, the latter part, is taken up with a Section on "Secrets of the Deep," containing particulars of a number of thrilling incidents connected with wrecks and treasure recovery, and these will make a strong appeal to the general reader. There are a number of diagrams and photographic illustrations. Altogether, the publication is an excellent production, and contains a vast amount of information on a subject which in a number of respects is closely associated with the work of the harbour engineer.



Diving Bells in use at Folkestone Harbour Works.

Great Western Docks. Ph. 51 + 334. Produced and published by H. N. Appleby, by arrangement with the Great Western Railway Company. Cardiff, 1938.

This excellent and comprehensive compendium of information about the dock systems under the control of the Great Western Railway Company is the successor of previous issues on the same lines, and it will be found, as heretofore, a valuable source of reference on all matters connected with berthage accommodation and facilities for shipping at the ports in question, containing, *inter alia*, lists of rates and charges, particulars of imports and exports, lists of docks' officials and all the variety of subjects on which knowledge is desirable for port users. The ports coming within the purview of the volume are Cardiff, Swansea, Newport, Barry, Port Talbot, Penarth, Plymouth, Milford Haven, Llanelly, Burry Port, Briton Ferry, Fishguard, Weymouth, Brentford, and some others of smaller account. The volume is well illustrated with photographic views, and contains a set of plans, one for each port, together with a general map of the Great Western Railway system. There are useful tables of tidal predictions for the year 1938 for the ports of Cardiff, Swansea, Newport, Barry, Port Talbot and Penarth. The book is well printed in clear type on good paper, and is provided with an artistic cover.

It is interesting and satisfactory to note in the Foreword that during 1937, the South Wales Docks experienced a considerable increase in traffic, as compared with the previous year, and the compiler reasonably claims in his statement that "there is little doubt that the docks of South Wales, coupled with the policy of the Railway Company in keeping their facilities and equipment thoroughly up to date, have proved to be the greatest sustaining factor in the power of South Wales to resist the adverse blows of the general world depression in trade." No one will refuse to endorse the hope that the coming year will show still further advance in the prosperity of South Wales and its docks.